Electrical World

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Democratization of Industry

A GREAT step forward was taken by the National Association of Electrical Contractors and Dealers at Milwaukee last Saturday when it approved a declaration of principles binding employer and employee to a realizing sense of the obligation each has to the other and which both owe to the community. Thus one member of the electrical quartet leads the others in the adoption of progressive ideals and in the application of democratic principles. Democratization henceforth is to be its shibboleth. Individualism is to give place to coöperation, and in working out the partnership the rights of the ultimate consumer are to be safeguarded. Nor are the electrical contractors the only signatories to the agreement. The other high contracting party is to be the International Brotherhood of Electrical Workers, whose leaders have already acquiesced in such a code of principles. The change of heart experienced on both sides is well exemplified in the third principle, which reads as follows: "Strikes and lockouts are detrimental to the interests alike of employee, employer and the public and should be avoided." This is neither Bolshevistic nor capitalistic, but is in keeping with the times and temper of the people. As every one knows, the labor crisis is here; the electrical contractors have met the issue in commendable fashion. In such action lies the greatest hope for the future well-being of the contractors and of the industry. In fact, the contractors have caught the vision which is as yet but dimly seen by some of the other branches of the whole electrical body.

More complete records of operating troubles would be worth their weight in platinum in many companies. Scrutiny of station log sheets discloses an appalling lack of detail in numerous instances bearing upon the causes, effects and remedies of difficulties occurring in plant service. After normal operation has been restored and before those concerned have had time to forget details of what happened, attention should be given to the preparation of those records which will become almost invaluable as the years pass.

Field Testing of Instrument Transformers

IN THE field testing of alternating-current systems—*i.e.*, in the testing of such systems at places outside of the electrical engineering laboratory—instrument transformers have to be employed in a great many instances. It becomes necessary to know both the ratio and the phase angle of these transformers. It might be supposed that all such transformers could be securely and conveniently calibrated in the laboratory, in advance of the field tests, and that their ratios and phase angles could be marked on the instruments, so as to be ready for immediate use. In practice, however, it often happens that the instrument transformers are not marked with their constants, or that, if so marked, there may be reasons for checking and redetermining these constants under the actual conditions of use. In all such cases the methods for testing instrument transformers are worthy of being carefully studied.

Prof. H. M. Crothers discussed in the ELECTRICAL WORLD last week some of the differential methods which may advantageously be used for the testing of voltage and current transformers. Some of these are very interesting, and particularly that which virtually produces a two-phase testing system out of a working three-phase system, even when the latter is out of balance, assuming that the "out-of-balance" is not unsteady.

Methods of testing adapted to different sets of conditions in general likelihood of use are of great value to the electrical engineer and deserve to be carefully studied and recorded.

Collective piece-work offers an opportunity for the application of bonus systems on a new and hopeful basis. Rewarding coöperative production by grouped units tends to eliminate slackers and to coördinate personnel to a higher efficiency in the use of equipment. We shall hear more of this in the next year or two, as the need of increasing production is forced home to American executives and subordinates.

Everybody in the Industry Works

IN STARTING his presidential year in the National Electric Light Association President Ballard is wisely calling upon the entire industry for organized effort. His first interview, printed in the ELECTRICAL WORLD of June 4, made this clear. His later acts have given it convincing emphasis. The new national executive is trying to make his slogan, that "everybody works," true indeed. No one can doubt for a minute that the policies which he has laid down for the development and increased usefulness of the association in the coming year will meet with a hearty support from the country at large. If there is something of the broad Pacific Coast spirit in what is done, if there is some injection of Pacific Coast policy into the regularly ordered affairs of the association, well, it is the Pacific Coast year, it comes from an earnest desire to make the organization better, it is all right. The rest of us—East, Central West and South—take off our hats this year to the sunset rim of the country, a big place where big ideas grow. Some other year it will be the turn of the Central West or the South or of the East again.

Canada, too, is entitled to its turn. Rotation in office is as good policy as honesty. It is a tremendous industry, still brimming with stupendous possibilities of growth, and all of the stimulating suggestions that any section can advance are worth getting.

We have already discussed Mr. Ballard's plan of organization under which the four vice-presidents are taking direct supervision of important parts of the association work. Another step which enlarges the interest in the program for the year by inviting more people to have a voice in counsel is the conference of about twenty leading men of the Pacific Coast, reported in our issue of last week. When men have something to say about what is done, their interest in it, their concern in its success or failure, is keener. Here was an unofficial meeting in a portion of the country which feels that it has been honored by the selection of a president from one of its companies. Is there any room for doubt that the spirit which develops will be one that will help to make the year a notable one in the history of the association? From the report of this conference it can be seen readily that certain issues loom larger in the eye of the Pacific Coast central station than in other parts of the nation. This was to have been expected, and it will be educational stimulus to the more highly developed industrial centers of the East to realize that the Pacific Coast members have problems which, though they are common to the industry in general, are really vital in the Far East.

Carrying to the whole membership the idea of consultation in regard to work in which all should have a hand, Mr. Ballard has asked for answers to three definite questions. His letter to members is a request for suggestions which might aid in carrying out the desire to make the association of service; whether there are problems on which information might be given to help in the solution; what suggestions can be offered to benefit other companies. These are simple queries which enter into the heart of the affairs of any company, large or small, which the association serves.

Unless rates are sufficient to attract a ready supply of fresh capital for utility extensions and improvements, they are not in the public interest. Without such an influx of funds service is bound to deteriorate and capital to be diverted to other activities which furnish a higher return but whose products are less important to the public.

Revising State Constitutions

IN THE political circles of the Middle Western States it seems to be particularly fashionable now to discard existing state constitutions and to draft new constitutions to take their place. From the business viewpoint the acts of constitution makers are much more important than those of an ordinary session of the state legislature. What a legislature does it may undo at the next session, but what a constitutional convention does is likely to stand for twenty-five years or more. Moreover, a constitutional convention is bound by no precedent or limitations except those imposed by the federal constitution. Its power for good or evil is great.

The bearing of this situation on the public utility business is especially apparent this year, when the established principles of state regulation are attacked so frequently. The obligation of companies to try by public appeal to prevent the inclusion of clauses unjust to business in new constitutions can be met partly through an effective state organization and partly through reliance upon favorable local public sentiment.

No greater mistake could be made than the assumption of anarchistic elements that because their rantings are not resisted or contradicted the people are all with them. When aroused, the American spirit acts with lightning speed and tolerance gives place to consuming wrath. Four million citizen soldiers did not put on olive-drab in order to destroy the constitution of the United States or to substitute Lenine and Trotzky for George Washington and Abraham Lincoln!

Economy in Transmission Routes

IT OFTEN happens in planning a power transmission that there are several available routes for the lines each of them offering topographical or strategic advantages. The choice between them is sometimes definitely fixed by these considerations, but now and then the question becomes a very close one as between one location and another, and may turn on the matters of general economy which P. O. Reyneau discusses in our columns this week. His method of solving the problem is in general the obvious one of balancing the annual costs, including capital charges, maintenance and energy losses, along the two lines to be considered, and he reduces the problem to comparatively simple equations, including the several variables backed up by curves which show for assumed conditions of somewhat normal character the relations derived from his equations. A notable feature of these curves is the comparatively small range covered as between the hypothesis of no depreciation and that assuming twenty years of life. The former figure would apply particularly to cases where the principal variable is the cost of right-of-way, the latter where difference in construction cost is the chief factor.

It must not be supposed that any formulas can actually give the final best solution for the economic conditions, but Mr. Reyneau's data are of great value in furnishing a simple and convenient way of getting at at least the preliminary facts. The fundamental trouble with all computations of this kind, as with those concerned merely with voltage and loss, is that a transmission line is a relatively permanent investment and the data can apply definitely only to one particular epoch. Changes in the absolute and relative costs of copper and aluminum, for instance, will make great difference in the concrete figures for minimum economy applying to the system at various times. The march of progress with respect to high voltages and the varying requirements of load are large factors which come into play in a manner which cannot be predicted. Things like these require almost a prophetic instinct to evaluate. Then, too, there are other matters to which Mr Reyneau calls attention, like the question of patrolling and maintenance as between a private right-of-way and one along a highway and the relative protection against storms to be afforded by various routes. These like the variables just referred to are matters for the shrewd judgment of the engineer rather than for exact computation, but when all these things have been considered Mr. Reyneau's data give a ready way of applying the economic criteria to compare results which might otherwise be still somewhat dubious.

Electrifying the Beet-Sugar Industry

NOW and then one encounters an industry which from its nature requires somewhat special treatment in passing to electric drive. Such an instance is found in beet-sugar production, which is gradually assuming increased importance. The United States requires about four times the sugar that it produces. Cane comes so near to being an exotic in even our most favorable climate that the sugar beet must be relied on chiefly, just as it is on the European Continent. Joseph Collopy's description of motor drive for beet-sugar factories is therefore very timely. It is worth noting, by the way, that this was actually the first commerical application of the electric motor just forty years ago, when, after the famous plowing experiment at Sermaize, France, the motor was installed at a nearby factory to run a hoist for unloading beets. To-day, as Mr. Collopy shows, electric drive is finding its way into the industry on a large scale, just as in Cuba and elsewhere it is being introduced with great success in cane-sugar making.

The conditions to be met are somewhat peculiar. In the first place, sugar making is a seasonal business, the actual operations being confined to about a hundred days after the crop is mature. During this time everything is driving hard, and then the factories shut down save for some operations concerned with the working up of by-products. Further, the load factor is high during the working period, and there is large use for steam heat, for which the exhaust can be used, so that there has been a strong tendency toward generating power on the premises. But the refuse cannot well be used for fuel, as it is in cane-sugar making, and local conditions must determine in how far it is economical to generate power uneconomically for the sake of steam as a by-product. In any case, many factories find it advantageous to take transmitted power for at least part of the load and to use it freely for all operations between the active seasons.

Motors installed in the sugar factories have much to contend with in the way of moisture. This is one of the good reasons for preferring direct connection to belt driving, especially considering the long season of inactivity when belts must be cared for. Likewise, the direct-current motor, once a favorite, has given place to three-phase machines of the squirrel-cage kind, which will stand all sorts of abuse, though, truth to tell, even they have sometimes been pushed past endurance. Most of the motors are of moderate size, rather widely scattered through the works, and some of them demand severe starting torque. Part of the operations require adjustable speed, secured by two-speed motors or by special devices, but as a whole there is little call for close regulation and a considerable proportion of the motors are essentially constant-speed. Even when power is locally generated, the tendency is strongly toward alternating-current equipment, and of course in using transmitted power this almost goes without saying.

Incidentally, the lighting of the factories is a considerable problem as the all-important diffusion cells and centrifugals demand good illumination inside. Experience has shown that strong general illumination from above best meets the conditions, and local lighting is, save for some exceptional cases, being given up in favor of the methods generally found best for factory lighting. As there are about a hundred beet-sugar factories in the country already and their number is likely to increase, we have here a field for electric motive power that is well worth consideration.

Small utilities are generally better off from being obliged to make extended returns to regulating commissions. Some of them learn for the first time what parts of their work are profitable, what are not, where and how economies are or may be practicable, how their costs compare with those of other companies, and where savings and improvements ought to be established. Considerable latitude in the character of returns required, however, should be accorded in cases where the keeping of elaborate accounts would be a hardship.

General Provisions for Industrial Lighting

THIS particular problem has been treated quite fully in our columns, but we are glad to add the discussion by Ward Harrison and H. H. Magsdick, the first section of which appears this week. It follows up their previous studies into the field of workmanlike and efficient design to meet the various concrete cases in definite and practical manner. Perhaps its greatest interest just at present lies in the very carefully prepared table of standards of intensity for industrial lighting based on the proposed code of industrial lighting for the State of Ohio. There are two general plans in use for specification of such lighting in connection with official requirements. One classifies the kinds of work rather by their lighting requirements than their specific character, forming thus a small number of groups of illumination intensities demanded, and leaves the rest to administration. The other plan followed in Ohio is to form a table, such as is given here, of a very large number of operations and classes of operations pertaining to various industries and to specify definitely the grade of lighting or foot-candle intensity which should be applied to each of these.

Just which scheme is the better it is impossible at present to say. The administrative difficulties are not relieved by the more exact classification to anything like the extent desirable, since differing conditions of work, even in spite of very detailed specification of operations, bring variations in requirements too great to be taken care of automatically. For instance, in the table before us hand painting and finishing takes illumination of intensity grade F, which ranges from 4 to 12 foot-candles, while carving and polishing stone is set down for grade E, 3 to 9 foot-candles. These limits leave in point of fact opportunity for individual judgment quite as great as if the industrial classification has been much less minute. As it stands, however, the table here presented is remarkably complete as regards its analysis of the conditions in a very varied series of operations, conducted in an extraordinary variety of industries. It is extremely well worth studying for this reason, and particularly with reference to the data which will follow regarding the suitable methods for obtaining lighting intensities up to any point required in the wide range of the schedule. By suitably tabulated data based on both theory and experience almost any reasonable requirement in the illumination of work spaces can be met, and the data given by the present authors should be of very large importance in planning new installations and in correcting the errors of the old ones. With such practical information ready at hand, there is surely no rational excuse left for bad lighting in industrial establishments.

Substations for Y-Connected Systems

Real Simplicity Is Attained in Both Lines and Outdoor Substations Standardized by Company Operating in the Northwest States, Where Light Loads and Long Distances Prevail

BY A. V. TAYLOR
Electrical Engineer Ottertail Power Company

THE problem of distributing electrical energy to small cities and towns has been greatly simplified by the advent of reliable outdoor electrical equipment which can be combined in the modern outdoor type of substation. Where a community is to be served from a high-voltage line requiring the

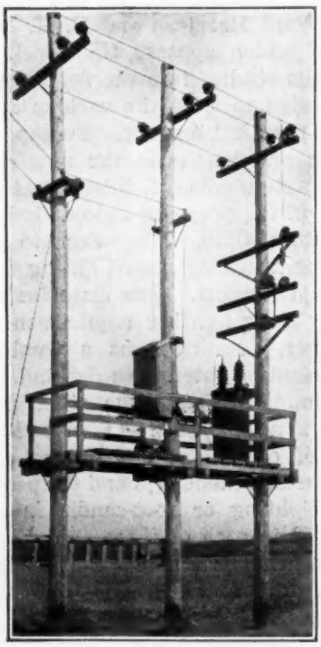


FIG. 1—STANDARDIZED SINGLE-PHASE 25-KVA. INEXPENSIVE SUBSTATION WITH ONE TRANSFORMER LEAD GROUNDED

installation of transformer capacity not exceeding 100 kva. or 200 kva., depending on line voltage, it is perfectly practicable to make use of an outdoor substation design which can be built within the highway limits, and thus obviate the necessity of operating companies owning a plot of ground on which to build a substation in each of the various small towns which they may reach.

In supplying energy to larger communities or to industrial plants where continuity of service is of greater importance, it becomes necessary to safeguard the service by means of lightning arresters, automatic oil-break switches and other apparatus, so that the outdoor substation necessarily becomes of greater size and more complex, in order to meet the additional requirements imposed upon it. High-voltage transformer banks exceeding 100 kva. and 200 kva. capacity are of such size and weight that it is ordinarily impracticable and uneconomical to mount them on structures off the ground.

The Ottertail Power Company, serving forty communities ranging in population from 200 to 9000 in western Minnesota, North and South Dakota, has developed and standardized three types of outdoor substations to serve various towns and cities from its lines. One feature of the transmission system of this company which has served to simplify the substations is that the high-voltage connection is Y, with all neutrals at both generating and receiving ends solidly grounded. This requires but one high-voltage lead to each single-phase transformer; the other transformer terminal being at ground potential, its lead wire is carried uninsulated to the overhead ground wire, which, being grounded at every transmission-line pole, furnishes a perfect ground for the neutral and saves considerable expense in providing a reliable grounding device at each substation. The practice of grounding every pole of the substation as well as the line poles, and of interconnecting all of these grounds, furnishes a good lightning-arrester ground for whatever arresters may be installed at the substation.

Fig. 1 illustrates a simple and inexpensive single-phase substation which serves to supply the smallest communities on the system. The substation is built as a part of the power line and takes the place of one of the transmission-line poles. The high-voltage lead simply runs through a choke coil and a combined disconnecting switch and fuse of the expulsion type to the transformer. The low-voltage side, ordinarily at 2300 volts, is protected by multi-gap lightning arresters and choke coils. Fuses and metering equipment inclosed in a metal-lined wooden box complete the low-

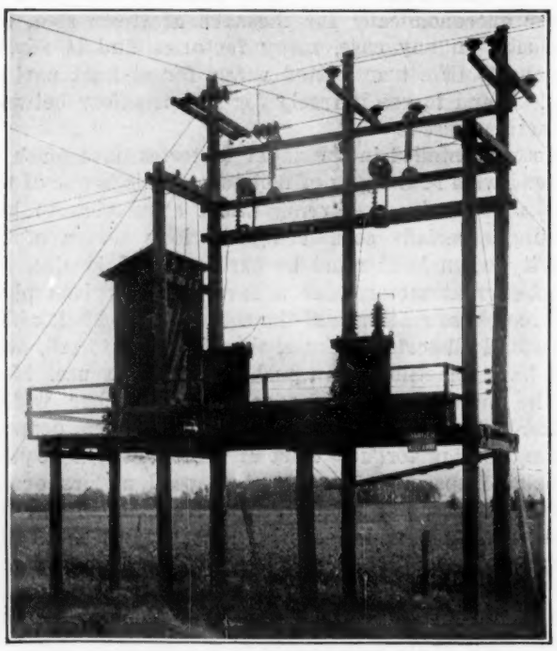


FIG. 2—THREE-PHASE INSTALLATIONS FOR SIZES UP TO 150 KW. (BUSHING OF ONE TRANSFORMER ON GROUNDED SIDE IS TEMPORARILY REMOVED)

voltage equipment. A treated wooden switch hook with the lower end grounded for the protection of the operator during wet weather is provided for operating the disconnecting switch. A box should be furnished to house and protect the switch hook from sun and rain.

Installations requiring three-phase service up to 150

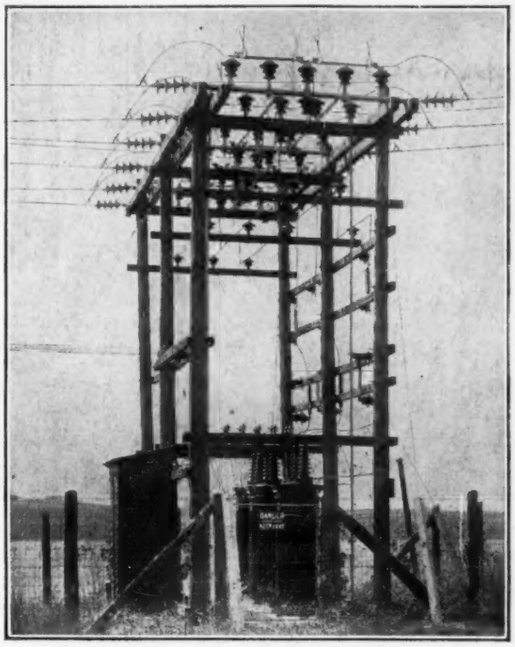


FIG. 3—THREE-PHASE 40,000/2300-VOLT TWO-PHASE TRANSFORMER STATION OF TYPE FOR 150 KVA. AND HIGHER

kva. from a 40-kv. line are accommodated by an outdoor substation such as is illustrated in Fig. 2. As in the case of the single-phase station, this structure is at the end of a standard span in the line. No lightning protection is provided on the high-voltage side as experience goes to show that the cost of apparatus protection is not offset by the increased insurance against service interruption. The overhead ground wire furnishes excellent lightning protection for the line itself and no doubt also lessens transformer burn-outs due to lightning.

When a town requiring three-phase service is first connected two transformers connected open-Y-open-delta are often used, the available rating later being increased 73 per cent by the addition of a third transformer.

As in the case of the single-phase station, simply a choke coil and a combined disconnecting switch and expulsion fuse are used on the high-voltage side. On the 2300-volt side the larger box accommodates multi-gap lightning arrester, meter equipment, automatic inverse-time-limit oil-break switch with primary trips and a few wiring or emergency repair supplies.

PLAN OF THE ELEVATED PLATFORM

The elevated platform which carries the power transformers and box housing the 2300-volt equipment has a minimum elevation of 10 ft. (3 m.) above the ground and is reached by means of a ladder, which is swung up and securely locked when not in use. These precautions, together with several "Warning" signs on the structure, should be sufficient to keep inquisitive persons and small boys from climbing on it.

Substations of this class of construction are far from being fireproof. The risk is minimized, however, by grounding the metal pins of all high-voltage insulators and the metal frame of all 2300-volt apparatus, by the use of extra-heavy tubes as entrance bushings for the 2300-volt circuit to the wooden box, by keeping the entire structure painted with a mineral paint, and by keeping the ground in the immediate vicinity of the structure clean of weeds and grass.

Incidentally another advantage of the Y-connected system is illustrated in Fig. 2. On one transformer in this picture there is but one high-voltage bushing. A short time before the view was taken lightning shattered the bushing on the side which was connected to the line. In a case of this kind the bushing on the grounded side serves as a spare and is placed on the "hot" side. The hole thus left in the transformer case by the removal of the "spare" bushing is covered with the shipping cap, the ground connection from the high-voltage winding being brought out under the shipping cap until such time as a new bushing is secured. This expedient has served more than once to keep a transformer in service.

TYPICAL OUTDOOR CONSTRUCTION

Construction typical of the outdoor-type substations developed for capacities of 150 kva. and above is illustrated in Figs. 3 and 4. For such installations electrolytic arresters are ordinarily provided as protection to the high-voltage equipment. A substantial concrete slab reinforced with scrap pieces of guy wire or other cheap reinforcement is provided to carry the complete arrester as a unit, so that the heaving action of the frost will not act to throw the lightning arrester oper-

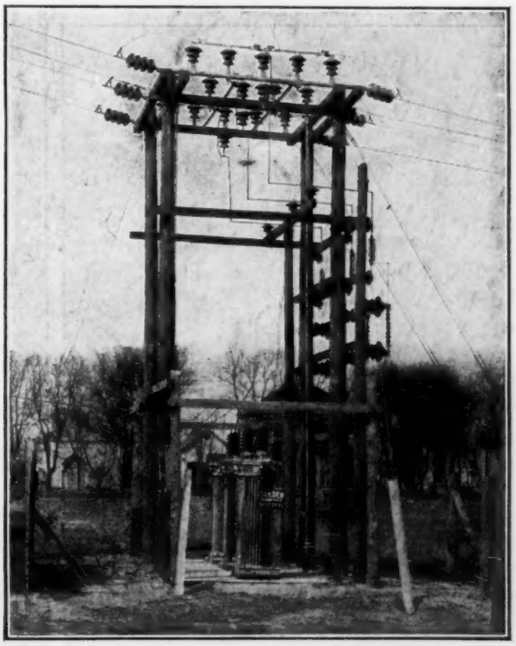


FIG. 4—ANOTHER TYPE OF OUTDOOR STATION FOR 150 KVA. OR MORE

ating mechanism out of proper alignment. A concrete slab makes a good base for large-size outdoor transformers.

A substation of this character should be inclosed by a suitable woven-wire fence topped with barbed wire and having a height of at least 7 ft. (2 m.) to effec-

tually prevent the public from coming into contact with dangerous conductors or electrolytic lightning arrester tanks. In parts of the country where snow covers the ground for a portion of the year wooden fences for inclosing substations are to be avoided as in the winter months they act as wind breaks and cause snow drifts to form within the inclosure. At other seasons wooden fences increase the fire hazard.

The 2300-volt leads are ordinarily carried overhead from such an outdoor substation to a nearby building which accommodates feeder panels, street-lighting equipment and such other apparatus as the particular situation may require. When the 2300-volt energy is sold in bulk, however, simply a small house to accommodate metering equipment, lightning arrester and oil-break switch is sufficient.

SWITCHING STATIONS WITHOUT HORIZONTAL STRAIN

A description of the substation equipment of a system of this kind would not be complete without reference to the sectionalizing switch equipment which is located at advantageous points for cutting out a section of transmission line when trouble occurs or when it is necessary to do any line work requiring the handling of high-voltage conductors. The general route taken by the high-voltage lines of this company is in the form of a rectangular loop about 20 miles by 43 miles (32 km. to 64 km.) in size, and with branch lines feeding off from this rectangle at many points. The principal source of power supply is a group of water-power plants concentrated near one corner of the rectangle. Line-sectionalizing switches are installed on both sides of every principal junction point on the high-voltage loop. It is thus possible to cut out any section of the loop and still serve every town from the water powers.

One design of rack for accommodating sectionalizing switches is shown in Figs. 5 and 6. Two air-break three-pole switches are mounted as a unit on top of the structure, each pole of the double-unit switch being carried on a substantial channel iron. These channel-iron bases are extended so as to overhang the rack, and the dead-end strain insulators carrying line conductors are attached directly to the ends of the channel irons; thus the tension of the line conductors is carried straight across the structure through the channels and obviates the necessity of the supporting structure taking this strain.

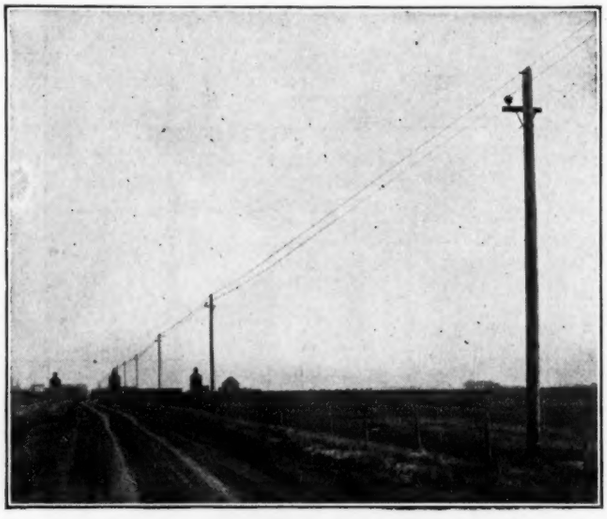
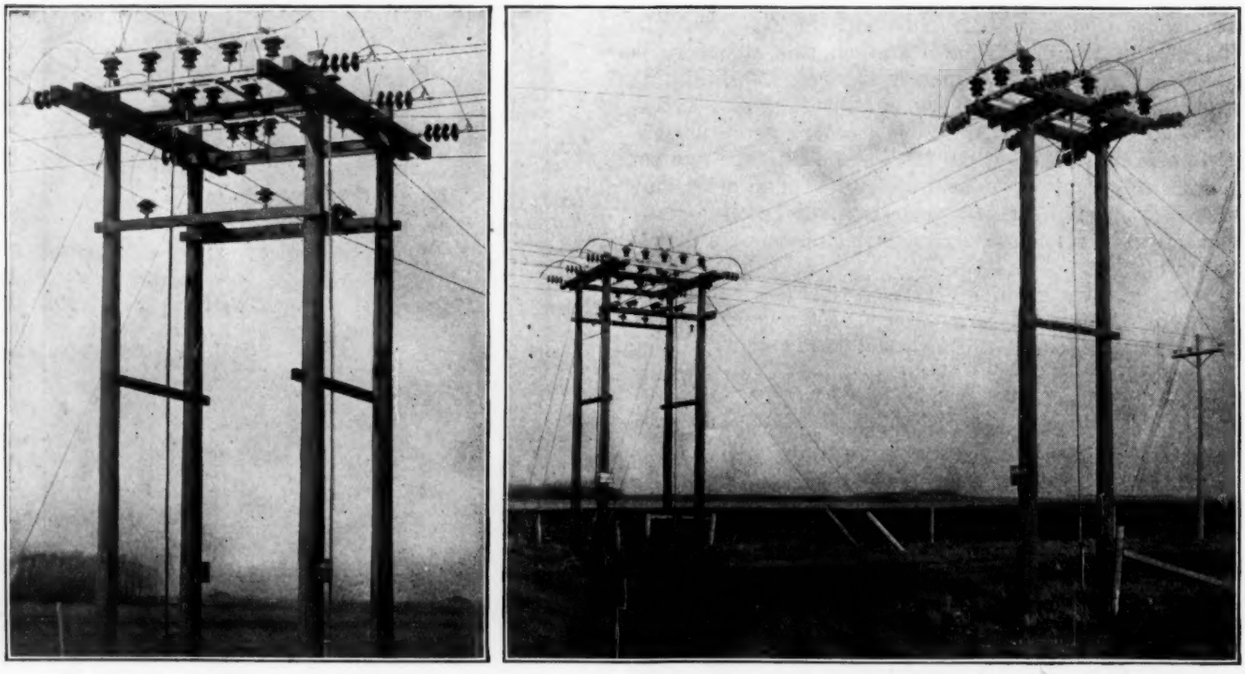


FIG. 7—Y-CONNECTION PERMITS THE SAVING OF ONE INSULATOR PER POLE AND ONE CONDUCTOR ON LIGHTLY LOADED LINES

Tap connections for the branch line to be served are carried by means of jumpers around the channel bases to insulators hung underneath each channel-iron base at the mid-point. From this point connection to the branch line is easily made. Another feature of



FIGS. 5 AND 6—SECTIONALIZING STATIONS IN WHICH LINE STRAINS HAVE BEEN LARGELY REMOVED FROM SURROUNDING STRUCTURES; ILLUSTRATION AT LEFT IS CLOSE-BY VIEW OF STRUCTURE IN BACKGROUND OF FIG. 5

these switching stations is that the switches are operated from the ground by means of a vertical operating shaft. Every switch is locked in either the open or closed position by means of a padlock on the operating handle. These locks are uniform for all switches, and the keys to unlock them are intrusted only to men selected to do such switching.

From an operating standpoint the installation of sectionalizing switches on a high-voltage network at all junction points is a matter of the greatest importance in order to maintain good service and to expedite line repairs.

SINGLE-CONDUCTOR TRANSMISSION

Reference has already been made to the simplification of substation layout made possible in a Y-connected system. The Y-connection also makes possible the use of a very simple and inexpensive line in the case of supplying single-phase electric service to a community not directly on the main transmission line. Such a line is illustrated in Fig. 7, which shows the overhead guard wire carried near the pole top and grounded at every pole, as is also the practice on the complete three-phase line. This is the neutral, and consequently it can be used as the return circuit of a single-phase transformer, thus necessitating running but one high-voltage conductor. In supplying small single-phase loads from a 22,000/38,100-volt Y line this practice has worked out satisfactorily in every particular.

CALCULATING GROWTH OF CURRENT IN AN INDUCTANCE

A Method That Simplifies Computations When Plotting Curves Showing Rise in Current in Induction Coils

BY DR. CARL HERING

THE formula for calculating the curve of the rise or growth of the current in an inductance like a spark coil, choke coil, inductance coil, etc., is quite tedious to use, as it involves a variable negative exponent and very small decimals of a second of time. The calculations are so troublesome that they are probably not made at all in many cases in which it would be better to make them. The abscissas are always the times in seconds and the ordinates the currents at those times; for any given or assumed time in fractions of a second the formula gives the current at that time. The reason why this calculation is a troublesome one is that these times enter in the negative exponent, and for plotting the curve they are introduced into the formula in simple numbers of thousandths of a second.

These calculations, however, become extremely simple if, instead of using seconds as the unit of time, one uses the time-constant of the coil as the unit, this time-constant being very easily determined once for all from the given constants of the coil. In that case certain constants, given below, can be calculated once for all, as they are the same for all coils, resistances and applied voltages. A series of six of these are given below, thus enabling six points of the curve to be determined by a simple multiplication, and six points, besides the origin and the asymptote, probably suffice for nearly all cases.

The usual formula is

$$I = \frac{E}{R}\left(1 - e^{\frac{-Rt}{L}}\right),$$

in which I is the current in amperes at any time t in seconds after the voltage E in volts has been applied, R is the total resistance in ohms (therefore including any resistance external to the coil itself), L is the inductance of the coil in henrys, and e is the base of the Naperian system of logarithms, namely 2.718281, the common log of which is 0.4342945.

The time-constant in seconds is equal to L/R. This is a fixed quantity for any given coil if R is the resistance of the coil alone. If R includes any external resistance, then this is the time-constant for that particular combination, as it is immaterial whether this resistance is in the coil itself or external to it; if external, the time-constant is of course different for each different amount of external resistance.

Since the time-constant is a fixed quantity for any given coil, it can readily be calculated once for all for any particular case, for plotting a curve of this description; call it k.

The exponent of e in the above formula then becomes minus t/k; hence if this k is taken as the unit of time instead of seconds, by making the times t simple multiples of k instead of simple decimals of a second, that is by making $t = k/2$, k, $2k$, $3k$, $4k$ and $5k$, the calculations become very simple, as the k's then cancel out, leaving e with simple digit exponents. Moreover, this enables the tedious part of the calculation—namely, that within the parentheses—to be made once for all for all coils, resistances and applied voltages, in the form of constant multipliers, thus reducing the above formula to this simple form:

$$I = nE/R,$$

in which n has the following values which are constants for all coils, resistances and applied voltages, t being the time in seconds and k the time-constant (therefore including the total resistance):

For $t = \frac{1}{2}k$	$n = 0.393469$
$1k$	0.632120
$2k$	0.864665
$3k$	0.950213
$4k$	0.981684
$5k$	0.993262

The quantity E/R is the final, steady current, or the "Ohm's law" current as it is often called. It is the horizontal asymptote which should always be given with such a curve and is therefore calculated once for all for each case. Pointing off two more decimals to the right, these values of n represent the percentage values of the growth of the currents at those times; hence after an interval of five times the time-constant the current has reached 99.32 per cent of its maximum, final, steady value, hence has practically reached its full value.

On cross-section paper the scale of the abscissas may, of course, be made seconds as before, these six points being then laid off at the numbers of seconds equal to the time-constant k (which is in seconds) multiplied by the corresponding digit.

EXAMPLE

As an illustration, suppose a coil has an inductance of 0.016 henry, a total resistance of 2 ohms, and is applied to 6 volts. The final current E/R will be 3 amp.; the time-constant $L/R = 0.008$ second. Then after $\frac{1}{2}k = 0.004$ second the current will be nE/R or 0.393 $\times$ 3 amp.; after, say, $3k = 0.024$ second it will be 0.950 $\times$ 3 amp., and so forth.

Selection of Economical Transmission Route

Development of Equation and Curves Which Simplify Choice Between Several Available Routes—Balancing Extra Cost of Right-of-Way for Short Route Against Expense for Greater Length of Ordinary Line Construction

BY P. O. REYNEAU
Distribution Engineer Detroit Edison Company

THE engineer who is planning a transmission line through any settled part of the country is confronted by the serious problem of the determination of route. It is seldom possible to follow anything like a direct "air line" route on account of the difficulty in obtaining right-of-way. If wooden poles or steel structures with small base are used, a route is ordinarily chosen which follows the highway in such a way as to arrive at the destination with the least possible length of line and the fewest possible difficulties in construction. It often occurs, however, that this choice is not a simple matter. There may be two or more routes each of which has advantages and disadvantages which more or less offset each other, there being no self-evident choice between them. It is then necessary to make a careful cost analysis to determine the most economical route. Then the relative economy of the various routes can be weighed against any other features which are not subject to a tangible cost comparison, and the most practicable route will usually be made evident.

Probably one of the most usual and simple problems of this kind is the choice between two routes one of which is shorter than the other but necessitates the purchase of a certain amount of right-of-way, while the other is longer but follows the highway and is not subject to right-of-way charges. It is the purpose here to show how the cost of two such routes can be readily compared and a general equation derived which will cover all such problems on any particular system. This equation can be used to determine curves that give a more tangible method of choosing the best solution.

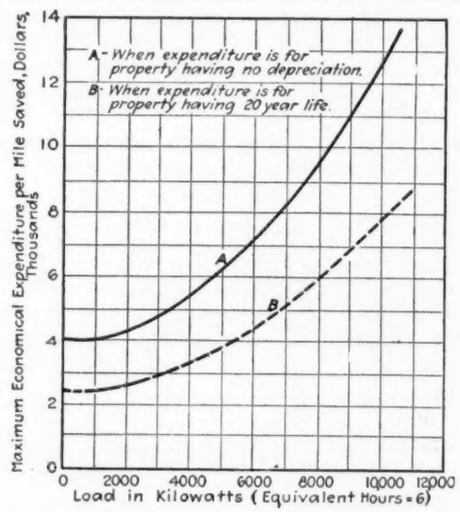
As a corollary to this problem we have the condition where there is a choice between a longer route, clear of trees and obstructions, and a shorter one which will require extra high structures, additional guying, etc. In fact the problem resolves itself into the question of "How much can we afford to spend in addition to the normal cost of construction in order to shorten a route?"

The basis for such a cost comparison will naturally be the annual cost of the two routes. If we can determine what will be the saving in annual cost of the shorter route over the longer when only normal line construction cost is considered, we can then tell what is the maximum amount which we would be justified in expending for right-of-way or additional material, etc., in order to use that shorter route. If the longer route should also require some extra construction expenses, these should naturally be included in the comparison.

The annual cost of any route is made up of the annual charges against the construction itself and the annual charges for the energy loss, the latter depending on the load carried and the size of wire used. It is first necessary to determine as accurately as possible what the unit annual charges will be on a normal line *i.e.*, one without exceptional difficulties.

Determination of Normal Line Cost

The annual charges against the construction will depend upon the standard type of construction used and on the cost of materials and labor in the locality under consideration. There must be obtained the total cost per mile of the line in place, including both material and labor costs on poles, cross-arms, pins, insulators, wire, grounds, guying, etc. To ascertain this the sizes and quantities of the various materials which would constitute an average normal mile of line must first be determined. The annual cost may then be obtained by figuring interest, taxes and depreciation on this first cost, allowing for the difference in depreciation between the different materials used. A certain amount per year should also be added for maintenance, patrolling, etc. The resulting annual cost per mile will be a constant for any condition of ioading, provided that the size of wire is fixed, and may be represented by K.



MAXIMUM ECONOMICAL EXPENDITURE PER MILE SAVED, IN ADDITION TO NORMAL LINE COST, TO SHORTEN ROUTE
If any corners are eliminated, add to amount shown by curve $500 for A and $308 for B for each corner

Usually when a shorter route is selected a number of corners are eliminated. The cost of a corner construction, especially on high-tension lines, may be quite an appreciable addition to the normal cost of the line. It can be figured, however, in the same manner as the normal line cost. This annual cost per corner may be represented by K.

Annual Cost of Energy Losses

The annual charges due to loss of energy may be determined as follows for a three-phase line:

Total energy loss $= 3I^2r$ watts per mile.

*Assisted by H. P. Seelye.

where I = current per wire
r = resistance in ohms per mile

$$I = \frac{W}{\sqrt{3}\,E\cos\theta} = \frac{kw \times 1000}{\sqrt{3}\,E\cos\theta} = \frac{578\ kw}{E\cos\theta}$$

where W = load in watts
kw = yearly peak load in kilowatts
E = voltage
cos 0 = power factor

then

$$\text{energy loss in watts} = \frac{3 \times 578^2\ kw^2\ r}{(E\cos\theta)^2}$$

Cost of energy lost per year =

$$\frac{3 \times 578^2\ kw^2\ r}{(E\cos\theta)^2} \times 365 \times t \times \frac{C_e}{1000}$$

where t = the average number of hours per day which the yearly peak load would have to run in order to give the total loss for the year, called the "equivalent hours."
C_e = the cost of energy per kilowatt-hour

If we assume a particular case, E, cos 0 r, t, and C_e will be fixed and the equation becomes :

Annal cost of energy loss = $K_2\ kw^2$ per mile

$$\text{where } K_2 = \frac{365.000\ r\ t\ C_e}{(E\cos\theta)^2}$$

When these constants have been evaluated for the particular conditions of the problem in hand, it is then possible to determine the total annual cost per mile with normal line construction and the total annual cost for any particular length including the corners.

Determination of General Equation

If we let L represent the difference in length between the shorter route and the longer, the savings in annual cost of the shorter route over the longer would be L times the annual cost per mile if normal line construction only is considered. This, then, represents the maximum amount which it would be economical to spend in addition to the normal cost of the line in order to utilize the shorter route. If the additional cost is for right-of-way, this annual amount is the maximum rent which one could afford to pay for it, or if the right-of-way is bought outright, this amount represents the interest and taxes on the maximum amount which could be paid for the necessary land. In the case where the additional cost would be for extra poles and other line material, the above savings would represent the interest, taxes and depreciation on the maximum amounts which could be so expended.

If L = the length in miles which would be saved by using the shorter route
C_1 = the maximum extra expenditure allowable in order to use the shorter route

C = the extra expenditure per mile saved = $\frac{C_1}{L}$,

N = the number of corners saved by using the shorter route
g = per cent annual charges on additional expenditure (interest, taxes, depreciation)
K_1 = the annual cost of normal line construction per mile
$K_2 kw^2$ = annual cost of energy loss per mile
K_3 = anual cost of a corner in addition to normal line cost

Then the annual charges on the additional expenditure for right-of-way, extra poles, etc., would be — $g/100\ C_1$

$$g/100\ C_1 = L(K_1 + K_2\ kw^2) + K_3 N$$

which is a general equation and can be applied to any such case if the proper values for the various constants are obtained. If then the contemplated shorter route can be used with a less expenditure than C_1 it would be an economical proposition to use it.

The above equation can be made even more general and be shown graphically by means of a curve if we reduce it to the terms of C, or the maximum allowable expenditure per mile of length saved, omitting the amount saved on corners, which will later be taken into account.

$$C = \frac{K_1 + K_2\ kw^2}{g/100}$$

The value of g as indicated above depends upon the nature of the additional expenditure. If it is for right-of-way, interest and taxes must be charged but no depreciation need be considered. We may take interest at 6 per cent, taxes at 2 per cent or g = 8 per cent. This represents yearly rental. If extra line material is to be purchased depreciation also must be added. Considering the life of such material as twenty years, depreciation = 5 per cent and g = 13 per cent.

Data for Curves

The accompanying curves were plotted assuming values for K_1, K_2 and K_3 as follows:

K_1 = \$320 (wood-pole construction)
r = 0.579 for No. 0 wire
t = six hours
E = 46,000 volts
cos 0 = 0.90
C_e = 0.01 cent per kilowatt-hour

$$K_2 = \frac{365{,}000\ r\ t\ C_e}{E\cos\theta} = \frac{0.69}{10^5}$$

K_3 = \$40
g = 8 and 13

$$C = \frac{320 + \frac{0.69\ kw^2}{10^5}}{0.08} \text{ and } C = \frac{320 + \frac{0.69\ kw^2}{10^5}}{0.13}$$

These equations were then plotted for various values of the load, kw. The curve "A" is plotted for g = 8 per cent or when the additional expenditures to be made in using the shorter route will be for such property as right of way, which has no depreciation. In case the right-of-way is obtained on a yearly rental basis, 8 per cent of the amount shown by the curve would be the allowable yearly rent. The upper curve is to be used when the extra cost will be for extra line material such as poles, stubs, guys, etc., for which the life was assumed to be twenty years and g = 13 per cent.

If any corners will be saved by using the shorter route, the cost of these may be added to the amount shown by the curve, or $\frac{K_3}{g/100}$ for each corner. If K_3 = \$40, this amounts to \$500 for g = 8 per cent and \$308 for g = 13 per cent.

Discussion of Curves

These curves, then, show the amount which could be spent in constructing a line in addition to the normal cost of construction under average conditions in order to shorten the length of the route one mile. The value of C when the load is 0 represents annual charges on

the normal construction cost of one mile of line capitalized at the percentage g, which is the percentage of annual charge against the additional property acquired and depends on its nature. As the load increases the value of C increases due to the increasing cost of the line loss.

The rise of the curves illustrates graphically the importance of knowing as accurately as possible the load and the load factor that it is intended to carry on the line, in order to correctly make the choice of routes. Though an accurate determination may be practicallv impossible, it is usually possible to work between some assumed limits that will represent a wide range of conditions and still lend themselves to analysis by means of the curves.

Furthermore, as the load increases, the point which stands out plainly is the great economy which will ordinarily be achieved by the use of a shorter route. For example, if right-of-way can be obtained for a yearly rental of $1 per pole, at 8 per cent this would represent $12.50 per pole, or at 35 poles per mile, $437.50 per mile. With a load of 4000 kw. the curves show that we could spend, according to curve A, $5,300 for each mile saved, which would purchase right-of-way at the above rate for 12 miles (19 km.) Or from curve B we could expend $3,300 for additional material in order to save one mile. If any corners were eliminated the amount would be still more. Hence if the actual expenditure necessary is any less than the above figures, the difference would represent a real saving and it would be substantial economy to use the shorter route.

Naturally the curves here given could not be used for any but the particular type of construction and voltage for which they were computed. It is a simple matter, however, to develop similar curves using appropriate constants to fit any other case from the equations given. The economy shown by such a curve, however, cannot be used as an absolute criterion in the choice of a route. There are other factors which do not lend themselves to such an exact cost analysis. The matter of patrolling a line and making repairs might be considerably more expensive along private right-of-way than along a main highway. The proximity to a railroad might considerably affect the cost of erection. The matter of protection against severe storms must be considered. Many other details will in any construction project present themselves for analysis. If, however, we have a concrete comparison of the relative economy of one route over another, we have gone a long way toward an exact determination of which of the alternate routes will be the more advantageous under all conditions.

As brought out at the beginning of this discussion, only one specific point in economies of routes has been covered here, that is, where the choice between two routes is to be made, the shorter one requiring purchase of right-of-way or installation of higher structures and special reinforcements. The many other problems in the choosing of the economical route for a transmission line could be treated in a very similar manner.

Electricity in Beet-Sugar Factories

Consideration of the Manufacturing Process in Its Relation to Load Characteristics and Some Suggestions on the Choice and the Preferred Location of Electrical Equipment

BY JOSEPH P. COLLOPY

SUGAR is one food article that the United States does not produce in large enough quantities to supply the needs of its own inhabitants, the people in 1914 consuming 89 lb. (40 kg.) per capita, while the production was only about one-fourth of this amount. At this time there were 99 factories in the United States, while in Europe there were 1253, indicating that there is a splendid possibility for the growth in the sugar-refining industry of this country. Since the raising of sugar cane is limited to a very small portion of the United States, the sugar-beet industry in one in which great growth must be looked for. To develop this industry a large amount of machinery will be required.

THE GENERAL PROCESS

In order that a clearer understanding may be secured of what is required in the electrical operation of a beet-sugar factory, a brief review of the process is given:

Due to the fact that sugar beets are lighter than water, running water is used for transporting them from the storage sheds to the factory. There they are elevated into a washer and cleaned mechanically by a number of wooden paddles that stir them around in water.

From the washer the beets are transferred by means of iron paddles to an elevator that takes them to the top of the factory, where pieces of wood, stone and other material are picked off. Then the beets are moved to automatic weighing scales and dropped into rotating cylinders containing fluted knives which slice the beets into small strips called cossetes. These are conveyed to a diffusion battery, composed of fourteen tanks or cells capable of holding about 2 tons (1800 kg.) to 4 tons (3600 kg.) of cossetes. By sending water through the mixture at the right temperatures, the sugar is extracted from the cossetes, which are then discharged through the bottom of the cell and conveyed out to a storage pit, or pulp pit, as it is called.

The juice extracted from the beets is saturated with CO_2 gas, filtered, resaturated with CO_2, filtered and filtered again. After reboiling the juice is filtered, saturated with sulphur dioxide and filtered again. The juice, which is very thin, is evaporated until it contains about 60 per cent sugar, when it is sent to the "blow-ups" or another sulphur station. After going through this the juice is ready for the crystallizing pan, where it is boiled under a vacuum of about 26 in. (66 cm.) with steam at 45 lb. (3 kg. per sq.cm.) pressure. At the completion of the process the contents of the pan are allowed to run by gravity into a mixer equipped with a slowly moving agitator. The centrifugals, which are fed directly from the mixer, consist of cylindrical copper screens inclosed by steel cylinders about 3 ft. (0.9 m.) in diameter and 2½ ft. (0.75 m.) deep. The sugar is separated from the molasses by rotating the centrifugals at a speed of about 1000 r.p.m. After being washed with pure water the sugar

is conveyed to the granulators, where it is dried and cooled.

The molasses separated from the sugar in the centrifugals and the water used in washing the sugar is very rich and is sent back to be reboiled, purified, run through the "brown" centrifugal crystallizers, and finally comes back to the "white" centrifugals again.

Most of the modern mills now have what is known as the Steffens process in addition to the regular process. The purpose of the Steffens process is to reclaim sugar from the molasses thrown off by the brown centrifugals. Briefly, the process consists of mixing with the diluted molasses a large amount of powdered quicklime. This mixing is done at a comparatively low temperature. The lime used in this operation is used in the first carbonation process. With the Steffens process about one-half of the sugar is saved from the discarded molasses. In connection with the Steffens process such equipment as lime kiln, skip hoists, rock crushers, pulverizing mills, etc., is used.

From the foregoing outline of the beet-sugar refining process it can be seen that quite a varied power load is found. It may also be noted that the largest part of the load consists of pumping and conveying. A large amount of water is used in the process. This water is used for conveying the beets and pulps and for washing the various apparatus throughout the mill. Besides the large amount of water that is pumped, the different juices and syrups must be pumped continuously. Centrifugal pumps are used wherever possible on account of their ruggedness and reliability. This is one of the features that make motor drive desirable, as a direct-connected motor is far superior to a belt drive for continuous service on a centrifugal pump. There are other types of pumps that must be used also, but most all of them can be driven to good advantage by motors. However, with the equipment on the market to-day some contend that certain large pumps can be driven to advantage by integral steam engines. These are the large vacuum and gas pumps, etc. This does not conflict with the general electrification because no line shafting is introduced and the exhaust goes into the low-pressure steam piping and is used for heating.

Difficulties Encountered with Using Line Shafting

The ordinary line-shaft drive is at a great disadvantage in a beet-sugar factory because the apparatus requiring power is widely scattered. In the old mills it is quite common to see a line shaft run 50 ft. (15 m.) to drive a small pump, and the writer has seen shafts run nearly 200 ft. (60 m.) in order to drive a scroll requiring not more than 3 hp. or 4 hp. It is exceptionally difficulty and costly to run line shafting about a sugar factory. There are a vast number of pipes of all sizes connected to the different apparatus. These pipes must always be run in order to avoid the shafting, or the shafting must be run with special care to avoid the piping. This requires special fitings in either case and often the results are not satisfactory.

Advantages of Electric Drive

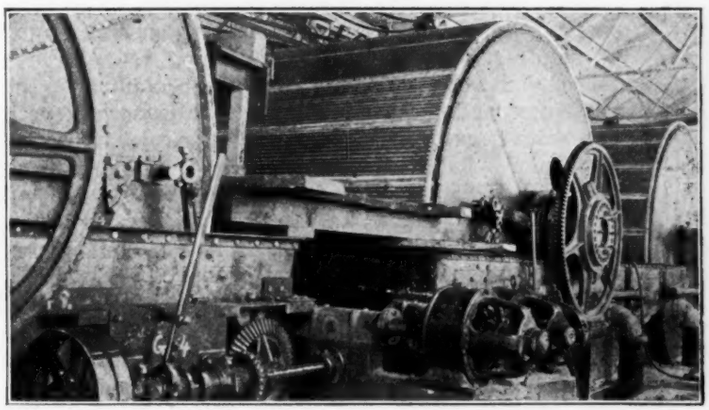
On machines like the centrifugals it is quite difficult to keep the belts in running condition. The belts travel at high speed and are subject to the strain due to numerous starts and stops. Under these conditions belts often break, causing costly shutdowns and endangering the safety of the operators. Direct-connected motors do away with these difficulties and in most cases are proving to be thoroughly satisfactory.

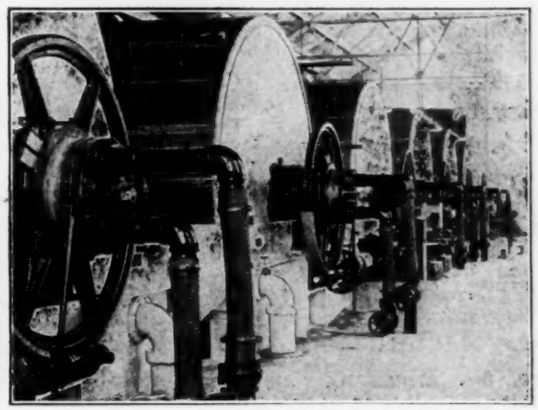
There are several stations that require accurate handling of different pumps that are located some distance away. With the steam-driven units this is made possible by an elaborate system of signals and by having the pump started and stopped by an operator stationed at the pump. With electric drive most of these difficulties are easily overcome.

It is for these reasons and many others that can only be appreciated after seeing some of the old layouts in operation that electric drive for beet-sugar factories is now considered the most satisfactory and economical.

Although experience has proven that electric drive is desirable for factories of this kind, the sugar industry offers only a fair field for the central station at present. With a load factor close to 85 per cent and a use for all exhaust steam, electric power can be produced very cheaply by the factory power plant. However, sugar factories find it very advantageous to be connected to the central station, using it as an auxiliary source of power during the campaign[1] period and quite often as the main source of power during the inter-campaign period. This inter-campaign load is becoming larger as processes connected with several by-products are being put into operation.

Only a few years ago direct current was used exclusively. However, at the present time alternating





FIGS. 1 AND 2—SLOW ROTARY REQUIRED FOR THESE FILTERS OBTAINED FROM MOTORS BY MEANS OF WORM-GEAR DRIVE

[1]The beet-sugar factory year is divided into two parts: the campaign and the inter-campaign. The campaign generally lasts about 100 days and is the time that the factory is in actual operation. After the campaign is over the factory is washed down from top to bottom with a quantity of high-pressure hose. A number of men are employed throughout the inter-campaign period and practically all the apparatus is thoroughly overhauled and put in first-class running order. Every precaution is taken in order to keep the factory in continuous operation after it is once started, as any delays cause many difficulties and a considerable loss of material.

current seems to dominate the field. The squirrel-cage motor has proven to be very satisfactory and requires less attention than the direct-current motor. An alternating-current power plant is more economical to build than the direct-current type. With alternating current the proper voltages for lighting and power circuits can easily be secured. The direct-current systems are generally operated at 220 volts, which does very well for the motor operation but does not work out so well for the lighting. Lighting at 230 volts does not prove satisfactory, as the lamps themselves are quite delicate and the breakage loss is high. In addition, 230 volts causes a number of grounds and short circuits in the various damp places where 115 volts would cause little or no trouble. If a balancer set is used to provide a 115-volt circuit another item of trouble is introduced which is quite serious sometimes.

The demands made on the motor are not such that a delicate speed adjustment or elaborate operating control is required. For this reason, the direct-current motor offers little advantage. It must be admitted that

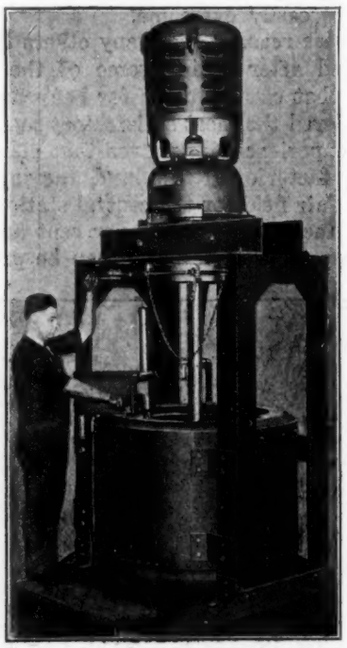


FIG. 3—VERTICAL-SHAFT MOTOR DRIVING SUGAR CENTRIFUGAL

the present-day commutating-pole motor, carefully inclosed, causes little operating trouble in the average position. However, on account of the general nature of the induction motor it will cause less trouble than any other type under conditions similar to those in a sugar mill. For these reasons and others that are not mentioned, experience has proven alternating current to be the most satisfactory.

In locating motors, control equipment and conduit, moisture, sugar dust, lime dust, sulphur gases, etc., are likely to be encountered. If the equipment is located at what is known as the beet end of the factory, it is subject to moisture and gases, and if at the sugar end it is subject to sugar dust which is constantly in the air. In some instances a tank or mixer may overflow, pouring its contents down on the floors below. Therefore splices and taps in conduits should be well taped and given a coat of waterproof insulating varnish wherever moisure is to be encountered. Control apparatus should be covered as much as possible.

If the motor drive is to be a success in sugar factories, much depends upon the location of the motor. If the motors are carelessly placed, they may be damaged by water or some other liquid. When motors were being first installed in factories of this type, quite often they were placed on the floor of a pump pit without sufficient drains. The result was that the motors were often so badly soaked that rewinding was made necessary and maintenance costs thereby increased. This tended to retard further electrification. However, if a little care is used in placing the motors and choosing the right type, they will demand far less attention than steam engines.

In many parts of the mill open-frame motors are satisfactory, but in other places the upper half of the motor should be inclosed if it is a squirrel-cage motor and totally inclosed with a supply of air from the outside if it is a direct-current motor. Open-frame induction motors around the lime kiln should be covered with a housing in order to keep off the dust. If not, they are neglected and will not operate with the desired reliability.

SPECIFIC POWER REQUIREMENTS OF DIFFERENT MACHINES

Below are given the motor requirements for a few sugar-mill operations. The horsepower required varies widely with the type of machine and the conditions under which it is operated. The manufacturers are now able to furnish accurate information along this line in most cases.

A beet wheel 16 ft. (4.8 m.) in diameter and of the average size, making 4 r.p.m., requires about 10 hp. The starting requirements are quite severe and high torque is required. If everything is running well, the beet wheel runs quite steadily, but at the beginning of the campaign[2] and toward the end of the campaign, with the beets in poor condition, numerous stops are necessary.

The beet washer also moves quite slowly, making about 15 r.p.m. Its operating conditions are about the same as those of the beet wheel. A motor of 10 hp. will be ample to operate the washer, but it must be well protected from the warm water splashed from the washer.

Beet elevators are made of various sizes and run at different speeds, the requirement differing with the size of the factory. A 15-hp. motor is about the average size used. In most of the new factories two elevators are run side by side.

A beet slicer running 60 r.p.m. and slicing 50 tons (4500 kg.) per hour requires 25 hp. High starting torque is required and a friction clutch is generally used.

Cossete conveyors are long rubber-covered belts about 12 in. (15 cm.) wide and travel at the rate of about 200 ft. (60 m.) per minute. In the average-size factory two conveyors are used and 5 hp. is required for each. The starting conditions are not severe.

Crystallizers move very slowly and are a steady drag with the load slowly increasing until the run is completed. A motor of 5 hp. is required for each crystallizer. If they are driven in multiple the average horsepower will be less than required for one. Molasses remains in the crystallizers during the "inter-campaign," and it is quite difficult to get them started after standing for a few months.

[2]See footnote No. 1.

The granulators are about 6 ft. (1.8 m.) in diameter and 30 ft. (9 m.) long. They make about 10 r.p.m. and must be started under full load. A 10-hp. motor will drive them. The speed is often regulated by a Reeves drive.

The centrifugals give the motors a very severe test and it is very important that they keep in running condition. The horsepower required varies according to the number of stops made and the size of the machine. Centrifugals that are direct-connected are generally driven by specially designed motors. The companies using individual motor drive have placed a friction clutch between the motor and the centrifugal. The motor is wound for two speeds. This makes a very simple electrical installation. When machines are driven by individual motors approximately 15 hp. is required for each machine, but when driven in multiple a 75-hp. motor will easily drive eight 40-in. (100-cm.) centrifugals; machines that are running help to bring the others up to speed. Multiple drive does not do away with high-speed belts, which are a constant annoyance.

The pumps about the factory require from 5 hp. to about 35 hp. and the majority of them run almost continuously.

The motors located in the Steffens house and around the line kiln should be totally inclosed with a supply of clean air from the outside, if they are anything but squirrel-cage motors, and besides should be covered with a housing. A skip motor and two fan motors are required for a set of two kilns. About 10 hp. is required for the skip and 5 hp. for each of the fans. Motors of about 50 hp. and 75 hp. are used in the Steffens house.

ILLUMINATION PROBLEMS AND SIGNAL SYSTEM

The proper lighting of a beet-sugar factory is quite a difficult task. The greatest hindrance is the large amount of piping next to the ceiling, and in addition there are a number of vessels that must be illuminated on the inside. In the most up-to-date factories general illumination has replaced most of the local lighting, but in some places a little local lighting is required. It is a very good place to try out the different types of shades. The diffusion cells into which the cossetes are poured must receive considerable light within them while being washed. Various schemes have been tried for illuminating them, such as lights on long cords balanced by weights, etc. However, good strong direct illumination from overhead seems to work best of all.

What has been said of the diffusion battery lighting may be said of the centrifugals except that the centrifugals are not as deep as the diffusion cells and the walls and white sugar help to reflect the light. However, much better light is required here than in the diffusion cells.

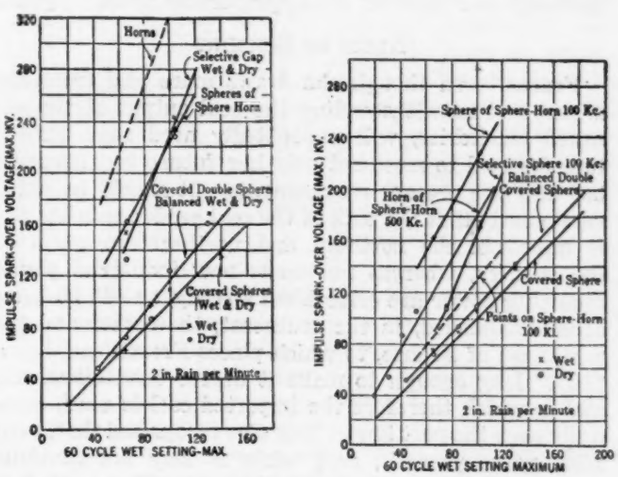
In most of the sugar-beet factories there are a number of signals consisting of electric bells, colored lights, etc. In some factories telephone systems are used, but it is doubtful if they are of much benefit. Some factories that had telephones installed later removed them. The bells are used for various signals such as starting and stopping the flow of beets in the flumes, starting and stopping of the beet wheel, indicating that various tanks are full, controlling pumping stations and many other similar functions. Bell signals help much toward the smooth operation of the boiler room by notifying firemen a few minutes in advance of the putting on or the taking off of a large vacuum pan. Gongs as large as 12 in. (15 cm.) in diameter are required in some places.

The colored lights are used to indicate the flow of different juices. That is, if "high green" juice is flowing between two stations a green light would be burning at both stations and if "low wash" was flowing a red light would be burning at each station.

PRACTICAL CONSIDERATIONS OF TRANSIENT VOLTAGE EFFECTS

Advantages and Disadvantages of the Varicous Arrester Gaps Under Different Weather Conditions and Wave Fronts

"Covered lightning-arrester sphere gaps afford a constant protective value under all conditions and are better than any one uncovered gap because both the impulse ratio and setting factor are low," said F. W. Peek in a paper entitled "The Effect of Transient Voltages on Diolectrics," presented at the recent convention of the American Institute of Electrical Engineers at Lake Placid, N. Y. The sphere horn, having electrodes of points, horns and spheres, gives very good protection over the whole range of frequency or wave front, owing to the different values of these two factors for its various electrodes. The spheres discharge the very steep waves, the horns the moderate ones, and


Horns
Selective Gap Wet & Dry
Spheres of Sphere Horn
Covered Double Spheres Balanced Wet & Dry
Covered Spheres Wet & Dry
Wet
Dry
2 in. Rain per Minute
IMPULSE SPARK-OVER VOLTAGE (MAX.) KV.
60 CYCLE WET SETTING-MAX.
Sphere of Sphere-Horn 100 Kc.
Selective Sphere 100 Kc. Balanced Double Covered Spheres
Horn of Sphere-Horn 500 Kc.
Covered Sphere
Points on Sphere-Horn 100 Kc.
60 CYCLE WET SETTING MAXIMUM

RESULTS OF TESTS ON DIFFERENT TYPES OF ARRESTER GAPS

the points continuous high-frequency static waves of very slanting front.

The protective value of selective gaps is a minimum for very steep wave fronts and a maximum for waves of slanting front, although over a wide range their protective value is very good. Wet atmosphere greatly affects the normal spark-over value of a gap but not the lightning spark-over value.

In commenting on Mr. Peek's paper, C. T. Allcutt, Westinghouse Electric & Manufacturing Company, East Pittsburgh showed a number of curves, in which he compared the ordinary impulse gap and a special development of the impulse gap with the sphere gap, giving the relation of impulse discharge in kilovolts to the 60-cycle setting in kilovolts. His conclusions were that the selective gap is always better than the sphere gap, and for severe cases it is 60 per cent better. The possibility of the sphere-gap pitting reduces its effectiveness, he declared.

Hydroelectric Energy in France

Coöperation of American Engineers and American Financiers Welcome in Developing the Natural Resources of the Republic and in Reorganizing Her War-Stricken Industries

BY C. W. A. VEDITZ, PH.D., LL.B.
Former American Commercial Attaché at Paris and Madrid

IT IS recognized by most authorities in France that if that country is to become a greater industrial nation she will have to find some substitute for coal as a producer of motive power. In normal times, and more particularly since Alsace and Lorraine have been restored to her, the industrial situation of France is largely explained by two fundamental facts: France has an abundance of iron ore and a shortage of coal.

In normal times France consumes about 60,000,000 tons of coal per annum, and her coal mines produce about 40,000,000 tons. (In 1913, the last complete year before the war, the amount was 40,844,000 tons, of which 67 per cent came from mines in the Nord and the Pas de Calais, regions invaded by the Germans.) France's imports in 1913 included 18,711,000 tons of coal, 3,070,000 tons of coke and 1,086,000 tons of fuel agglomerates, such as briquettes, etc. Most of the coal came from Great Britain, most of the coke from Germany and most of the agglomerates from Belgium.

NEEDS OF INDUSTRY

France, even though she draws more coal from her mines, and notwithstanding the coal output of the annexed territories, will undoubtedly need some substitute for coal to meet not only her future requirements but also her present requirements. It should be noted particularly that the bulk of the coal produced in France is mined in the northern and northeastern parts of the country, whereas numerous new industrial plants requiring power are established already, or will be hereafter established, in the southeast, the center and the southwest of France, to which places French coal has a "haul" long enough to make it dearer than elsewhere, and in which therefore the imported coal is used, especially near the port towns. It is also recognized that, even after peace prevails, coal, while it may not continue to be as dear as it was during the war, will nevertheless be much dearer than before the war; likewise it is obvious that labor will be dearer in productive enterprises than it was before the war. On the basis of these facts the following conclusions may be drawn:

(1) Labor will be dearer and scarcer, and therefore there will be increased incentive to substitute machinery and motive power for labor and human or animal power.

(2) Coal will continue to be insufficient for the needs of the nation as a producer of power and will probably cost much more than it did before the war. The mines in the region invaded by the Germans have been left in a state deplorable beyond expression. The French chief inspector of mines states that many of them will require from five to ten years to put into full working order.

(3) The new industrial establishments that will be established or that will expand their activities in the southern, western and central parts of the country, where coal is relatively dear, will welcome some other and a more economical method of producing power.

(4) Attention will have to be turned more largely in the direction of utilizing what the French call "white coal"—hydroelectric energy. The trend in this direction was manifested before the war and has been emphasized during the war to a noteworthy extent, inasmuch as several newly established plants working for the government in the manufacture of munitions, and especially chemical products and gases, have utilized hydroelectric energy on a comparatively large scale.

HYDRAULIC RESOURCES OF EUROPE

From the standpoint of utilizing industrially the power of falling water, France is well placed. According to Robert Pinot, general secretary of *Forces Hydrauliques*, the following is the rank of European nations with respect to available hydroelectric power:

Norway	7,500,000
Sweden	6,750,000
Austria-Hungary	6,460,000
France	5,857,000
Italy	5,500,000
Spain	5,000,000
Switzerland	1,500,000
Germany	1,425,000
Great Britain	963,000

These figures, taken apparently in part from the engineer Pacoret and in part from reports of the German Union of Electricians, have of course been subjected to much discussion. One of the leading French advocates of the use of "white coal," M. Ader, estimated the minimum available power in France as 4,600,000 hp. and the average power as 9,200,000 hp. P. M. de la Brosse, engineer-in-chief and director of the hydroelectric service of the Alps, agrees on 4,600,000 hp. as the minimum realizable power. Others give as a rule higher figures. But, of course, all of them fall short of the 30,000,000 hp. said to be available in the United States.

Comparing the available power with the size of the several countries, France has 6 hp. per acre (15 hp. per hectare), Norway 15 hp. per acre (37 hp. per hectare), Sweden 8 hp. per acre (20 hp. per hectare), Austria-Hungary 7½ hp. per acre (19 hp. per hectare), Spain 4 hp. per acre (10 hp. per hectare), Switzerland, 4 hp., and Germany 1.2 hp. per acre (3 hp. per hectare).

The available power is, of course, unevenly distributed throughout the French Republic. Half of the national area has no utilizable waterfalls. M. Ader has estimated that the minimum power or the low-water productivity of the Southern Alps region (the Savoys and the Dauphinate) is 1,000,000 hp.; for the Jura, the Vosges and the so-called Massif Central, 900,000 hp., and 1,400,000 hp. for the remainder of the country, including the Pyrenees region. According to de la Brosse, the distribution is as follows: 2,300,000 hp. for the Alps and the Pyrenees; 900,000 hp. for the center and the east, and 1,400,000 hp. for the rest of the country.

There is little doubt now that these figures are too low for the Alps departments of France.

GREAT WATER-POWER OPPORTUNITIES

It if be remembered that in 1868 and 1869 two paper manufacturers of the province of Dauphiné installed the first plants using waterfalls for power purposes along modern lines, and that the problem of transporting the power over considerable distances was solved between 1880 and 1900, France has made but little use of her opportunities. In 1911 only 600,000 hp. was produced in all of France, of which total 473,000 hp. is in the Alps, 55,000 hp. in the Pyrenees and 51,000 hp. in the so-called Massif Central. It is probable that at the present time the total is from 850,000 hp. to 900,000 hp. The figures for 1916 probably represent about one-tenth of the available power, whereas Germany has utilized about one-half of the power utilizable in that country, despite the fact that Germany is a great coal-producing, and even coal-exporting, nation.

According to Prof. Auguste Pawlowski, France spent in 1913 1,000,000,000 francs ($200,000,000) for hydroelectric industrial establishments, of which 650,000,000 francs ($130,000,000) went into enterprises for the production and transportation of power, and 200,000,000 francs additional have been since that time devoted to hydroelectrical industries. Says this authority: "The work is still in its beginnings. All the available power should be realized, and in the quickest time possible, in the interest of the economic uplift of the country, of its social regeneration and of its wealth, and in order to permit it to conquer the markets of the world. White coal gives us the means for compensating our lack of coal, enables us to obtain electricity at a low price, to lower in many cases our industrial costs of production, and to improve our agriculture. It will become the surest weapon in the economic struggle of after-the-war."

M. Loucheur, former French Minister of War, now Minister of Industrial Reconstruction, and a leading authority on industry and transportation, speaking of the plan for utilizing the Rhone falls at Genissiat, presented by Messrs. Blondel, Harlé and Mahl, stated that it would involve the annual production of 1,300,000,000 kw.-hr. As each kilowatt-hour corresponds to 1-200 kg. of coal, the falls at Genissiat would represent 1,600,000 tons of coal, or the equal of more than one-third of the output of the coal mines of Lens or Anzin, or more than all of the output of the coal mines of Blanzy, the richest in the interior of France.

The most important utilization of French "white coal" would probably be for railway traction. In 1909, according to the statistics of the "Service des Mines," the steam locomotives, or those using self-produced power, represented a total of 7,373,000 hp. while traction current did not amount to more than 138,000 hp. Since then, however, a large number of electric tramway lines in the larger towns have been substituted for horse cars, and numerous so-called secondary railways and local railway lines have been electrified. In the Alpine region the tramways of Lyon and Grenoble, the railways of Dauphiné and those along the Mediterranean coast are comparatively recent developments.

The tramways of Bayonne, Biarritz, and Pau are propelled by hydroelectric energy, but those of Toulouse, Perpignan and a number of other towns in this southwestern region are still tributary to steam-power establishments. Some local railway systems are operated by hydroelectric power. The big French Midi (Southern) railway system has inaugurated electric traction upon certain sections of its roads, and proposes to electrify 327 km. of its lines (150 miles). But at the present time there is hardly as much as 250 km. (120 miles) of railways and street tramways utilizing hydroelectric energy in all the south of France.

In the center of France, hydroelectricity operates the tramways of the Haute Vienne region, of Loir-et-Cher, of Puy, of Limoges and of a few industrial towns like St. Etienne and Roanne. In all, France in 1914, at the outbreak of the war, used hydroelectric energy for only a fractional part of her local or general railway systems and lines.

FRANCE LOOKS TO AMERICA

In conversations which I had from time to time with engineers and with public officials in France interested in hydroelectric developments, the suggestion was repeatedly made that France would welcome the coöperation of American engineers and of American capital in French engineering enterprises. They recognize our achievements in this line, and while they sometimes resent the "Look who's here" attitude of American visitors, proud of the industrial and scientific progress we have made in controlling the resources of our vast continent, they now feel that the work of reorganizing industrial France after four years of exhausting war is not the work of France alone but of the whole of allied civilization. To be sure, our engineering concerns hesitate to "go ahead" upon the basis of uncertain costs of material, of unusually high wages, of political factors of a more or less disconcerting nature. But did we not find it possible to make war under strange and foreign conditions, and do it fairly successfully? Are we less adaptable in the arts of peace than we have proved ourselves to be in the arts of war?

THIS nation has three great forces—physical, commercial and moral. The part played by our wonderful army and navy in the war has led the world to respect and fear our physical force. The immense production of our fields and factories, and the tremendous trade developed since the August of 1914, have also induced the world's respect, and again its fear. Our moral force is the great unknown quantity that adds the fear of the world to the respect which it holds for our physical and commercial forces. If our physical force is divided against itself by the vicious agitator, his brainless followers and their unfortunate dupes, the world will lose its respect for both our physical and commercial forces and we shall have no moral force. But if our people present a united front of integrity of purpose, our physical force will retain the world's respect, with the fear of none except those who would destroy principle. Our commercial force, being based on fairness, will also carry respect, and without fear except from the false trader, and our moral force will grow into a mighty power.—*Fred. I. Kent, vice-president Bankers' Trust Company.*

Design of Industrial Lighting System

Very Complete Data Are Given to Indicate Present Standards of Lighting in All Principal Industries—A Tabulation Also Makes It Possible to Calculate Utilization Factors for All Important Lighting Units

BY WARD HARRISON AND H. H. MAGDSICK
National Lamp Works of the General Electric Company, Cleveland

IN THE designing of an industrial lighting installation one of the first questions to arise is: "Shall the system be one of local lighting with a single unit allotted to a given machine or operation, or shall the system be entirely general with overhead units uniformly located throughout the room so that the illumination will be approximately the same over all of the work and its surroundings, or shall the system be a combination of local and general to provide a high intensity on the work and a moderate intensity of illumination throughout the room?"

Experience has shown that local lighting where the units are suspended at about the eye level of the workmen does not work out advantageously in practice. It is practically impossible to provide such a system which will not be objectionable from the standpoint of sharp contrasts in intensity; the lamps are small and less efficient than the larger lamps used in general lighting; they are frequently subject to theft, for they are of a size adapted for home use, and they cannot be kept properly adjusted in the reflectors. No matter how satisfactory such an installation may be when it is first put in, it is soon brought to a state of inefficiency. Such an installation is not businesslike, and its cost, though rarely analyzed, is high. Viewed from the standpoint of lost production, increased spoilage and increased liability of accident, its cost is quite excessive. There are, however, some instances in which an operation cannot be satisfactorily illuminated by an overhead system. Where this is the case, no general procedure for calculating the size and location of units can be formulated because of the wide range of conditions likely to be encountered, but the general requirements for good illumination must not be lost sight of. Where local lighting is necessary, there should be a moderate amount of general illumination in order that extreme contrasts between the intensity of light on the work and that on the surroundings may be obviated. Regular and frequent maintenance is essential.

Design of General Lighting System

While no universally applicable procedure can be formulated for the design of an installation of localized lighting, a definite method may be established for carrying out the design of a general system of illumination. The several steps in this procedure are as follows:

1. Selection of a suitable lighting unit.
2. Selection of the desirable intensity of illumination.
3. Determination of the coefficient of utilization; that is, the percentage of total light from the lamps effective on the work.
4. Determination of total light flux to be supplied by the lamps.
5. Determination of location and number of outlets.
6. Determination of the size of lamp for each outlet to provide most nearly the amount of light desired.

The selection of the lighting equipment best suited for a given installation must be made with regard for the requirements of good illumination, as outlined in "Selecting Equipment for Industrial Lighting—I," by Ward Harrison and H. H. Magdsick, in the ELECTRICAL WORLD of June 21, 1919. In part II of this article the properties of the various reflecting and diffusing accessories are analyzed with reference to these several requirements. (See ELECTRICAL WORLD, July 5, 1919.)

Selection of Intensity

The proper intensity of illumination to be supplied is dependent upon numerous factors, as discussed in the previous articles just referred to. The general range of various classes of operations is indicated in Table I. The reflection factor of the working surfaces, the nature and fineness of the detail to be observed and the closeness of application required must particularly be taken into consideration. As a preliminary check upon the power requirement it is well to remember that 1 watt per square foot in gas-filled lamps equipped for direct lighting corresponds roughly to an intensity of 6 foot-candles on the horizontal plane in the usual industrial interior.

The relative efficiency of the various units in lighting a horizontal plane at the work and in delivering light to vertical planes at the same height above the floor was fully covered in the previous articles. In general the units which are rated high in the first respect also rank well in the second. However, some units which direct a very high percentage of their flux at angles above 45 deg. will rate relatively higher on illumination of vertical surfaces than on horizontal illumination. With most kinds of equipment discussed in this paper the intensity of light on a vertical plane will be very nearly one-half of that measured on the horizontal. With very broad curves, however, this proportion may run as high as 0.6 and with focusing curves as low as 0.4 of the horizontal illumination.

Determination of the Coefficient of Utilization

With the intensity determined, the total number of lumens which must be supplied at the working level is obviously equal to the selected intensity in foot-candles multiplied by the area of the space in square feet. The lamps must, however, emit a greater number of lumens, for not all of the light generated reaches the plane of the work. Some of it is absorbed in the reflecting or diffusing accessories. Part of it strikes the walls and ceiling, and of this some is absorbed and only a portion is reflected to the work. The amount so lost depends upon the characteristics of the lighting unit, the finish of walls and ceiling and the proportions of the room.

Within the limits of usual practice, absolute height in feet at which units are mounted has in itself no influence upon the percentage of light utilized, so long as the same proportions are maintained. For example, if there are two buildings, one 20 ft. by 50 ft. and 10

TABLE I—PRESENT INTENSITY STANDARDS IN INDUSTRIAL LIGHTING

Industrial Classification	Intensity Grade	Foot-Candle Intensity
Aisles	B	½ to 2
Assembling:		
Rough	D	2 to 6
Medium	E	3 to 9
Fine	F	4 to 12
Extra fine	G	8 to ..
Automobile Manufacturing:		
See machine shops, paint shops, woodworking shops, etc.		
Bakeries:		
Mixing and baking	E	3 to 9
Boiler, Engine Rooms, Power Houses:		
Boiler rooms, coal and ash handling	C	1 to 3
Auxiliary equipment, oil switch and transformer rooms	D	2 to 6
Switchboards, engines, generators, blowers, compressors	E	3 to 9
Brewing, Distilling, Bottling:		
Clearing or resting and fermenting, cool ship	C	1 to 3
Boiling	D	2 to 6
Bottling, keg washing, keg filling	D	2 to 6
Bottling	E	3 to 9
Candy Making:		
Cooking over furnaces, cooling slabs, cream-beater machines, dipping (hand) molding, revolving pan, spinning bench, weights and measures, wrapping and packing	E	3 to 9
Canning and Preserving:		
Cooking, assorting, cleaning, cutting, peeling, hand filling, machine filling	E	3 to 9
Chemical Works:		
Hand furnaces, boiling tanks, stationary dryers, stationary or gravity crystallizing	C	1 to 3
Mechanical furnaces, generators, stills, mechanical dryers, evaporators, filtration, mechanical crystallizing, bleaching	D	2 to 6
Tanks for cooking, extractors, percolators, nitrators, electrolytic cells	E	3 to 9
Tanks for cooking, extractors, percolators, nitrators, grinding (fine), electrolytic cells	E	3 to 9
Clay Products and Cements:		
Kiln yards	B	½ to 2
Kiln rooms, grinding, filter press rooms	C	1 to 3
Molding and pressing, cleaning and trimming	D	2 to 6
Enameling	E	3 to 9
Coloring and glazing	F	4 to 12

Industrial Classification	Intensity Grade: Light	Intensity Grade: Dark	Foot-Candle Intensity: Light	Foot-Candle Intensity: Dark
Cloth Products:				
Cloth treating (oilcloth, etc.)	E	F	3 to 9	4 to 12
Cutting, sewing (machine), sewing (hand), pressing, inspecting	F	G	4 to 12	8 to ..

Industrial Classification	Intensity Grade	Foot-Candle Intensity
Construction:		
Outdoor	B	½ to 2
Indoor	C	1 to 3
Dairy Products:		
Separators, evaporators, churns, molds, presses, pasteurizing, bottling, canning, labeling, ice-cream freezers	E	3 to 9
Drafting	G	8 to ..
Electric Manufacturing:		
Storage battery, molding of grids	E	3 to 9
Coil and armature winding, mica working, insulation molding, other insulating processes, wire insulating	F	4 to 12
Lamp manufacturing	G	8 to ..
Elevators, Freight and Passenger	C	1 to 3
Forge Shops and Welding:		
Rough forging	D	2 to 6
Fine forging, drop forging, spot and butt welding, arc welding	E	3 to 9
Foundries:		
Charging floor, tumbling, cleaning, pouring and shaking out	C	1 to 3
Rough molding, core making (rough)	D	2 to 6
Fine molding, core making (fine)	E	3 to 9
Glass Works:		
Mix room, furnace room, casting and lehr	D	2 to 6
Grinding, glass-blowing machines, cutting glass to size, silvering	E	3 to 9
Fine grinding and polishing, beveling, etching, decorating, inspecting (medium)	F	4 to 12
Glass cutting (cut glass), inspecting (fine)	G	8 to ..

Industrial Classification	Intensity Grade: Light	Intensity Grade: Dark	Foot-Candle Intensity: Light	Foot-Candle Intensity: Dark
Glove Manufacturing:				
Cutting, pressing, knitting	E	F	3 to 9	4 to 12
Sorting, stitching, trimming, inspecting	F	G	4 to 12	8 to ..
Halls, passageways in interiors	B		½ to 2	
Hat Manufacturing:				
Dyeing, stiffening, cleaning, refining, braiding	D	E	2 to 6	3 to 9
Forming, sizing, pouncing, flanging, finishing, ironing	E	F	3 to 9	4 to 12
Sewing	F	G	4 to 12	8 to ..
Ice Manufacture:				
Ice making	D		2 to 6	
(For boiler rooms, engines, compressors, etc., see above.)				
Inspecting:				
Rough inspecting	D		2 to 6	
Medium inspecting	E		3 to 9	
Fine inspecting	F		4 to 12	
Extra fine inspecting	G		8 to ..	
Jewelry and Watch Manufacturing:				
Bench work, extra fine machine work, machine work, stamping, engraving, jewel working	G		8 to ..	
Laundries and Dry Cleaning:				
Washing	D		2 to 6	
Sorting, marking, mangles, machine ironing, pressing, hand ironing, dry and steam cleaning	E		3 to 9	
Leather Manufacturing:				
Vats	C		1 to 3	
Cleaning, tanning, stretching	D		2 to 6	
Cutting, fleshing, stuffing	E		3 to 9	
Finishing, scarfing	F		4 to 12	

Industrial Classification	Intensity Grade: Light	Intensity Grade: Dark	Foot-Candle Intensity: Light	Foot-Candle Intensity: Dark
Leather Working:				
Pressing, winding	E	F	3 to 9	4 to 12
Grading, matching, cutting, scarfing, sewing	F	G	4 to 12	8 to ..

Industrial Classification	Intensity Grade	Foot-Candle Intensity
Locker, rooms	C	1 to 3
Machine Shops:		
Rough bench and machine work	D	2 to 6
Medium bench and machine work, automatic machines (ordinary), grinding (rough work), buffing and polishing (medium work)	E	3 to 9
Fine bench and machine work, automatic machines (fine), grinding (medium work), buffing and polishing (fine work)	F	4 to 12
Extra fine bench and machine work, grinding (fine work)	G	8 to ..
Meat Packing:		
Slaughtering	D	2 to 6
Cleaning, cutting, cooking, grinding, packing, canning	E	3 to 9
Milling and Grain Food Products:		
Cleaning, grinding or rolling	D	2 to 6
Baking or roasting	E	3 to 9
Offices	F	4 to 12
Packing:		
Rough	D	2 to 6
Medium	E	3 to 9
Fine	F	4 to 12
Paint Manufacturing	D	2 to 6
Paint Shops:		
Firing, dipping or spraying	D	2 to 6
Rubbing, hand painting and finishing (ordinary)	E	3 to 9
Hand painting and finishing (fine)	F	4 to 12
Hand painting and finishing (extra fine). (Automobile bodies, piano cases, etc.)	G	8 to ..

Industrial Classification	Intensity Grade: Light	Intensity Grade: Dark	Foot-Candle Intensity: Light	Foot-Candle Intensity: Dark
Paper-Box Manufacturing:				
Cutting, machine folding, hand folding, pasting, assembling	D	E	2 to 6	3 to 9

Industrial Classification	Intensity Grade	Foot-Candle Intensity
Paper Manufacturing:		
Beaters, machine, grinding	D	2 to 6
Calendering	E	3 to 9
Finishing, cutting, trimming	F	4 to 12
Passageways; see Halls		
Plating:		
Plating, polishing, burnishing	E	3 to 9
Printing Industries:		
Matrixing, casting, miscellaneous machines, presses (job and small automatic), presses (rotary, flat bed, etc.)	E	3 to 9
Proofreading, lithographing, electrotyping	F	4 to 12
Linotype, monotype, typesetting, composing stone, engraving	G	8 to ..
Receiving and Shipping	D	2 to 6
Roadways and Yard Thoroughfares	A	1/20 to ¼
Rubber Manufacturing and Products:		
Compounding, mills, fabric preparation, stock cutting, tubing machine, solid tire operations, mechanical goods building, all vulcanizing	D	2 to 6
Calenders, bead building, pneumatic tire building and finishing, inner tube operations, mechanical goods trimming	E	3 to 9
Sheet Metal Working:		
Bench work (ordinary), miscellaneous machines	E	3 to 9
Bench work (fine), punches, presses, sheers, stamps, welders, spinning	F	4 to 12
Shafting, Pulleys and Other Mechanical Transmissions	C	1 to 3

Industrial Classification	Intensity Grade: Light	Intensity Grade: Dark	Foot-Candle Intensity: Light	Foot-Candle Intensity: Dark
Shoe Manufacturing:				
Hand turning	E	E	3 to 9	3 to 9
Miscellaneous bench and machine work	E	F	3 to 9	4 to 12
Lasting and welding	F	F	4 to 12	4 to 12
Inspecting and sorting raw material, cutting, stitching (hand)	F	G	4 to 12	8 to ..
Stitching (machine)	G	G	8 to ..	8 to ..
Soap Manufacturing:				
Framing	C		1 to 3	
Kettle houses, cutting, soap chip, soap powder	D		2 to 6	
Stamping, wrapping and packing, filling and packing soap powder	E		3 to 9	
Stairways	B		½ to 2	
Steel and Iron Mills, Bar, Sheet and Wire Products:				
Soaking pits and reheating furnaces	B		½ to 2	

TABLE I—PRESENT INTENSITY STANDARDS IN INDUSTRIAL LIGHTING* *(Continued)*

Industrial Classification	Intensity Grade	Foot-Candle Intensity
Steel and Iron Mills, etc. (continued):		
Charging floor, casting floor	C	1 to 3
Muck rolling, heavy rolling, pickling and cleaning, shearing (rough by gage)	D	2 to 6
Automatic machines, rolling (rod, light and cold), mill, wire drawing, shearing (fine by line)	E	3 to 9
Stonecutting:		
Machine cutting, hand cutting	D	2 to 6
Carving, polishing	E	3 to 9
Store and Stock Rooms:		
Rough stock	C	1 to 3
Medium stock	D	2 to 6
Fine stock	E	3 to 9
Structural Steel Fabricating	E	3 to 9
Telegraph:		
Operating	F	4 to 12
Telephone:		
Manual exchanges	E	2 to 6
Automatic exchanges	F	4 to 12
Testing:		
Rough	D	2 to 6
Medium	E	3 to 9
Fine	F	4 to 12
Extra fine	G	8 to ..

Industrial Classification	Intensity Grade		Foot-Candle Intensity	
Textile Mills—Silk:				
Winding, throwing, dyeing	E	E	3 to 9	3 to 9
Quilling and warping, weaving, finishing	E	F	3 to 9	4 to 12
Textile Mils—Woolen:				
Carding	D	D	2 to 6	2 to 6
Picking, washing, combing, twisting, dyeing, knitting machines (ordinary and nappers), cordage mills	E	E	3 to 9	3 to 9
Drawing in, warping	E	F	3 to 9	4 to 12
Knitting machines (flat and others)	F	F	4 to 12	4 to 12
Weaving	F	G	4 to 12	8 to ..
Perching	G	G	8 to ..	8 to ..
Textile Mills—Cotton:	Light	Dark	Light	Dark
Opening and lapping, carding, drawing frame, warping, slashing	D	D	2 to 6	2 to 6
Roving, spooling, spinning, etc., drawing in, weaving, dyeing	E	E	3 to 9	3 to 9
Tobacco products	E		3 to 9	
Toilet and washroom	C		1 to 3	
Woodworking:				
Rough sawing (saw mills), bench work (rough)	D		2 to 6	
Sizing, planing, rough sanding, etc., machine woodworking (medium), bench work (medium), gluing and veneering, cooperage	E		3 to 9	
Machine woodworking (fine), bench work (fine), fine sanding and finishing	F		4 to 12	

* This table, the most complete of its kind so far published, giving the grades and preferred values of intensity for the various industrial operations, is taken from the Appendix to the Proposed Code of Industrial Lighting for the State of Ohio. The minimum values proposed as mandatory on the principal plane of the work for the several grades are as follows:

Grade	Proposed Mandatory Minimum Intensity in Foot-Candles	Grade	Proposed Mandatory Minimum Intensity in Foot-Candles
A	1/10	E	2
B	1/4	F	3
C	1/2	G	5
D	1		

ft. in height (6 m. by 15 m. by 3 m.) and the other 40 ft. by 100 ft. and 20 ft. in height (12 m. by 30 m. by 6 m.), it is clear that the effective angle and hence the efficiencies of the lighting systems in the two buildings will be the same. If the small building is illuminated by eight 100-watt lamps on 10-ft. centers and the large building by the same number of 400-watt lamps on 20-ft. centers, the average intensity of illumina-

TABLE II—COEFFICIENTS OF UTILIZATION

Color (Reflecting Value) of Ceiling / Walls			Light (70%)			Medium (50%)		Dark (30%)
			Light (50%)	Medium (35%)	Dark (20%)	Medium (35%)	Dark (20%)	Dark (20%)
Reflector Type	Light Output	Installation Classification (See Note 1)						
Clear Lamp	90° to 180°—9% / 0° to 90°—76%	1	.46	.43	.41	.42	.40	.40
		1½	.54	.51	.48	.50	.47	.47
		2	.60	.57	.54	.56	.53	.53
		3	.65	.62	.60	.61	.59	.59
		5	.69	.67	.65	.66	.65	.64
Bowl-Frosted Lamp	90° to 180°—8% / 0° to 90°—73%	1	.45	.42	.40	.41	.39	.38
		1½	.52	.49	.47	.48	.46	.46
		2	.56	.53	.51	.52	.50	.50
		3	.62	.60	.57	.58	.56	.56
		5	.66	.65	.63	.63	.62	.62
Opal Cap	90° to 180°—8% / 0° to 90°—66%	1	.40	.37	.35	.37	.34	.34
		1½	.47	.44	.42	.44	.42	.42
		2	.51	.48	.46	.48	.46	.46
		3	.56	.54	.52	.53	.51	.51
		5	.60	.58	.57	.57	.56	.55
Clear Lamp	90° to 180°—8% / 0° to 90°—65%	1	.38	.36	.34	.35	.33	.33
		1½	.45	.43	.41	.42	.40	.40
		2	.49	.47	.45	.46	.44	.44
		3	.54	.52	.50	.51	.49	.49
		5	.59	.57	.55	.56	.54	.54
Bowl-Frosted Lamp	90° to 180°—8% / 0° to 90°—60%	1	.37	.34	.32	.33	.31	.31
		1½	.43	.40	.38	.39	.37	.37
		2	.46	.44	.42	.43	.41	.41
		3	.51	.49	.47	.48	.46	.46
		5	.55	.53	.52	.52	.51	.50
Silver Cap	90° to 180°—9% / 0° to 90°—65%	1	.33	.31	.30	.31	.29	.29
		1½	.39	.37	.35	.36	.34	.34
		2	.43	.41	.39	.40	.38	.38
		3	.47	.45	.43	.44	.42	.42
		5	.50	.49	.47	.48	.47	.46
Clear Lamp	90° to 180°—10% / 0° to 90°—74%	1	.36	.31	.28	.30	.28	.27
		1½	.44	.39	.36	.37	.35	.35
		2	.50	.46	.42	.44	.41	.42
		3	.56	.53	.48	.51	.47	.48
		5	.62	.59	.54	.57	.53	.54
Shielding Bowl	90° to 180°—1% / 0° to 90°—65%	1	.38	.36	.34	.35	.33	.33
		1½	.44	.42	.40	.41	.39	.39
		2	.49	.47	.45	.46	.44	.44
		3	.54	.52	.50	.51	.49	.49
		5	.58	.56	.55	.55	.54	.53
Clear Lamp	90° to 180°—6% / 0° to 90°—66%	1	.44	.41	.39	.41	.39	.38
		1½	.50	.47	.45	.47	.45	.44
		2	.55	.52	.50	.52	.50	.49
		3	.59	.57	.55	.56	.54	.54
		5	.63	.61	.59	.59	.58	.58
Clear Lamp	90° to 180°—40% / 0° to 90°—0%	1	.22	.19	.17	.14	.12	.07
		1½	.27	.24	.22	.17	.15	.09
		2	.31	.28	.26	.20	.18	.11
		3	.36	.33	.31	.24	.22	.13
		5	.42	.39	.37	.28	.26	.16

Color (Reflecting Value) of Ceiling / Walls			Light (70%)			Medium (50%)		Dark (30%)
			Light (50%)	Medium (35%)	Dark (20%)	Medium (35%)	Dark (20%)	Dark (20%)
Reflector Type	Light Output	Installation Classification (See Note 1)						
Clear Lamp	90° to 180°—18% / 0° to 90°—73%	1	.46	.42	.39	.40	.37	.36
		1½	.54	.50	.47	.48	.45	.44
		2	.60	.56	.53	.54	.51	.50
		3	.67	.64	.61	.61	.58	.56
		5	.73	.70	.67	.67	.64	.62
Bowl-Frosted Lamp	90° to 180°—34% / 0° to 90°—51%	1	.34		.28	.29	.26	.24
		1½	.41		.35	.35	.33	.30
		2	.47		.41	.40	.38	.35
		3	.53		.47	.45	.43	.40
		5	.59	.56	.53	.50	.48	.45
Bowl-Frosted Lamp	90° to 180°—20% / 0° to 90°—60%	1	.40	.37	.34	.35	.33	.32
		1½	.47	.44	.41	.42	.39	.38
		2	.52	.48	.46	.46	.43	.42
		3	.58	.55	.52	.52	.49	.47
		5	.62	.60	.58	.57	.55	.52
With Reflector	90° to 180°—6% / 0° to 90°—58%	1	.31	.28	.26	.28	.25	.25
		1½	.37	.34	.32	.33	.31	.31
		2	.42	.39	.37	.38	.36	.36
		3	.47	.44	.42	.43	.41	.41
		5	.51	.49	.46	.48	.46	.45
Light Opal	90° to 180°—35% / 0° to 90°—40%	1	.23	.20	.17	.18	.16	.14
		1½	.30	.26	.23	.24	.21	.19
		2	.35	.31	.28	.28	.25	.22
		3	.41	.37	.34	.33	.30	.26
		5	.48	.44	.41	.39	.36	.31
Diffusing Bowl	90° to 180°—20% / 0° to 90°—60%	1	.32	.28	.26	.27	.25	.23
		1½	.40	.36	.33	.34	.32	.30
		2	.45	.41	.38	.39	.37	.35
		3	.52	.47	.44	.45	.42	.40
		5	.59	.54	.51	.51	.48	.46
Reflector and Bowl	90° to 180°—17% / 0° to 90°—55%	1	.32	.28	.26	.28	.25	.25
		1½	.39	.35	.33	.34	.31	.30
		2	.44	.40	.38	.39	.36	.35
		3	.49	.45	.43	.44	.41	.40
		5	.54	.50	.48	.49	.46	.45
Light Opal	90° to 180°—60% / 0° to 90°—25%	1	.27	.24	.21	.20	.17	.14
		1½	.34	.30	.27	.25	.22	.18
		2	.39	.35	.32	.29	.26	.21
		3	.45	.41	.38	.34	.31	.25
		5	.51	.47	.44	.40	.37	.29
Dense Opal	90° to 180°—70% / 0° to 90°—10%	1	.24	.21	.19	.16	.14	.10
		1½	.30	.27	.24	.20	.18	.13
		2	.34	.31	.28	.23	.21	.15
		3	.39	.36	.33	.27	.25	.18
		5	.45	.42	.39	.32	.30	.21
Diffusing Glass Plate Bottom	90° to 180°—55% / 0° to 90°—16%	1	.25	.22	.20	.18	.17	.14
		1½	.30	.27	.25	.22	.21	.17
		2	.34	.31	.29	.25	.24	.19
		3	.38	.35	.34	.29	.28	.22
		5	.43	.41	.40	.33	.32	.24

Note 1.—"Installation classification" is a factor introduced to make this table applicable to rooms of widely different proportions. In general, the greater the width of a room for a given height of light sources, the higher will be the coefficient of utilization. Therefore, in most cases the "installation classification" may be determined by dividing the room width by the ceiling height. This holds in all layouts using indirect and semi-indirect lighting units, and for direct-lighting units also, except when used in rooms with ceilings above 15 ft. In these cases more precise classification is obtained by dividing the room width by twice the mounting height of units above the plane of work. Note 2.—All of the values apply to installations in square rooms having sufficient lighting units symmetrically arranged to produce reasonably uniform illumination. To obtain the coefficient for any rectangular room, find the coefficient for a square room of the narrow dimension and add one-third of the difference between this value and the coefficient for a square room of the long dimension.

tion will be the same (neglecting the difference in efficiency of the units), and its distribution will be similar. On the other hand, the proportions of a given building or room have a very important bearing upon the percentage of light utilized. In Table II are shown the coefficients of utilization, as the percentages are called, for the more common reflecting equipments when used in square rooms. For rooms having a width equal to or but little greater than the ceiling height, a lower utilization obtains because a relatively greater portion of the light strikes and is absorbed by the walls than is the case for a room of more extended floor area. In Table II values are given for rooms in which the ratios of room width to ceiling height are 1, 1½, 2, 3 and 5. For rooms of sizes between the dimits specified proportionate value should be used; where the room dimension exceeds five times the ceiling height, the increase in the coefficient is so slight as to be almost negligible, and the coefficient for a ratio of 5 may be used.

For rectangular rooms the coefficient of utilization may be determined by adding to the coefficient for a square room of the short dimension one-third the difference between this value and the coefficient for a square room of the long dimension. For example, for a room 50 ft. by 160 ft. (15 m. by 48 m.), with a ceiling height of 20 ft. (6 m.), in which the ceiling is light and the walls are dark and dense semi-direct units are employed 16 ft. (4.9 m.) above the plane, the coefficient of utilization is found to be 0.30 plus one-third the difference between 0.30 and 0.39, or 0,33 (figures based on the ratio of room width to ceiling height). For RLM dome reflectors with frosted lamps in the same room, the figure would be $0.47 + \frac{1}{3}(0.63 - 0.47) = 0.52$ (figures based on double the mounting height; see Note 1, Table II).

Further data upon which to base design calculations will be presented in the next number of this series in an early issue of the ELECTRICAL WORLD. A typical illumination problem will then be worked out showing the proper use of the various tables.

TELEPHONE DEVELOPMENT DURING FEDERAL CONTROL

Mr. Vail Discusses Physical and Financial Condition of Property as It Will Return to Company Control—Notable Advances

A letter to shareholders of the American Telephone & Telegraph Company by Chairman Theodore N. Vail discusses conditions and the outlook as the period of government control ends. Mr. Vail says in part:

There has been no policy adopted by the Postmaster-General during the period of federal control which was not in the interest of the service and with which your organization has not been in full accord. This coöperation has resulted in the maintenance of the service at the highest standard possible under the extremely arduous conditions.

Your property has been maintained and will be returned in as good physical condition as though it had never been out of your possession. Of your organization the same can be said, barring the effect of the indefinite, indeterminable disturbances which always accompany radical changes, and barring the effects of the decimation of our force by war service (some 15,000 of our best employees were taken into the national service) and that caused by the impossibility of immediately meeting the abnormal wages paid in other lines of industry. These necessarily affected our service, through lack both of sufficient and of well-trained employees to cope with an abnormal increase in demand for service. This is gradually being remedied by the return of our employees and officers from war service and by the gradual increase of our wages in order to meet existing conditions.

The applications for rate increases, which were, as a rule, being favorably acted upon until commission action was suspended by federal control coming into effect, have been replaced by the readjustment of rates ordered by the Postmaster-General, which has now become effective.

Because of the rapid increase of expenses and the temporary suspension of increase in revenue, the compensation awarded the system under government control for the five months of 1918 and the first three months of 1919 was not earned by about $9,000,000, after providing full allotment for depreciation and obsolescence, determined and undetermined. Under the increased revenue from the readjustment of rates, the compensation will be earned.

After that period, from all present indications, the question of rates will receive prompt attention and all reasonable consideration from state commissions of control and regulation, and the necessary revenue adjustments to establish a proper equilibrium between expenses and revenues will be made. In this readjustment it is hoped that some reduction of rates may be possible.

During the period of federal control the work of development and research made gratifying progress, and many notable advances in construction, equipment and methods were brought to completion. Among the improvements were the following:

The radio transmission of conversation, under favorable static conditions, over practically unlimited distance is now an accomplished fact, and the extension of our intercommunicating system to the high seas contiguous to our coasts is only a matter of time.

The amount of copper needed for a telephone circuit has been reduced to a small fraction of the weight formerly required, while the capacity of that telephone wire circuit has been increased from a single conversation to a number of simultaneous conversations; and the same circuit can at the same time be used for telegraphic transmission many times in amount that formerly transmitted over a single telegraphic wire.

The relative capacity and consequent relative value of the underground ducts and conduits, costing hundreds of millions of dollars, have been increased many tens of times by improvements in cable structure and reduction in wire weight.

The possibilities of long-line transmission through circuits in underground cables have increased from but a few miles to distances which will cover many of our longest lines having a sufficient number of circuits to warrant the expense of an underground conduit, and the possible distance of transmission will probably increase as fast as the concentration of the wires make it economical to use aërial or underground cable construction, which means large ultimate economies in maintenance and reconstruction.

Machine switching is fast coming into use under certain conditions, and while it may never fully take the place of manual operating, it will relieve the tension in many places by taking up a considerable part of the growth.

Multiple machine telegraphic transmission has greatly increased the possibilities of new and additional service for the public advantage.

Cable submarine transmission has been greatly improved and increased, making possible increased services over existing plant and ultimate reduction in charges for certain classes of services, especially the more distant service.

While it is probable that there will be continued increase of expenses in the future, due to the necessary increase of wages to meet the commendable desire for better living conditions, there will be no relative increase in charges for existing services.

Increased operating charges will be largely met by getting better service from the same or even less exertion of personal effort, aided and supplemented by mechanical appliances, and by the revenue from the increased services of now unused facilities and from additional services over the same plant.

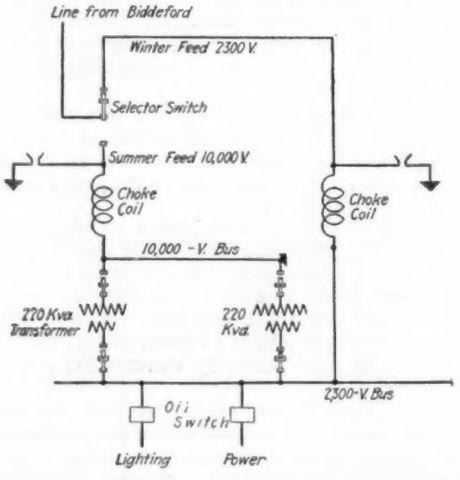
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

WINTER AND SUMMER LOAD IS SERVED ECONOMICALLY

Seaside Resort Furnished Energy from 10,000-Volt Line in Summer, but the Winter Load Does Not Warrant the Use of Transformers

Although the summer load at the Old Orchard Beach (Me.) resort is sufficient to warrant the use of a 10,000-volt transmission line, the constant loss in the step-up and step-down transformers is an appreciable proportion of the entire load in winter. Therefore se-



TRANSMISSION LINE CAN BE OPERATED AT 10,000 VOLTS OR 2300 VOLTS AS DESIRED

lector switches have been provided on both ends of the transmission line so that this district can be fed with either 2300-volt or 10,000-volt energy, the step-up, step-down losses being eliminated with the lower voltage. As shown by the accompanying line drawing, the selector switches by-pass the step-up and step-down transformers at the generating and delivery ends of the line when 2300-volt energy is being transmitted.

GROUNDING RULES FOR POWER-PLANT OPERATORS

Precautions Which Must Be Taken by Employees of Power Company Before Working Upon Any High-Tension Apparatus

Considerable danger is involved in working on high-tension apparatus if care is not taken to ascertain whether the apparatus is disconnected from the line and whether it has been completely grounded or not. In order that the workmen should be fully instructed in correct grounding methods, the Pennsylvania Water & Power Company, of which Alex Bauhan is station superintendent, has incorporated the following in the company's safety rules:

Grounding connections for 70,000-volt circuits shall be at least No. 4 copper wire equivalent; for 11,000-volt and 13,000-volt circuits it shall be at least No. 4/0 copper equivalent, and grounding jumpers shall be provided with clamps or terminals of corresponding carrying capacity.

The following is prescribed as the procedure before grounding a 11,000-volt circuit or apparatus:

Be sure that the circuit is clear, test for potential with a switch hook, and touch the conductor with an insulated test stick the end of which is connected by an insulated wire through a potential transformer fuse to ground.

The grounding jumpers must first be connected to ground. Then apply the ground clamp to the first conductor of the circuit in such a manner that a solid connection is made from the beginning, so that should the conductor have been made alive since testing, the making of a quick solid connection prevents the formation of a bad arc and the burning of the man. Make the connection to the second and third conductors of the circuit in the same way, assuming in every case that the circuit might be alive when the ground is applied. Never allow any part of the body to touch a conductor on which the ground has not been made. The fact that one conductor has been successfully grounded does not necessarily indicate that the other conductors are clear. The static effect on an ungrounded transmission-line conductor caused by neighboring live circuits is in some cases sufficient to cause death.

In removing a ground the same precautions must be observed—namely, not to touch the conductor after the ground connection has been removed. The ground jumper should be disconnected first from the line conductors and last from the ground connection.

In grounding 70,000-volt conductors, if within the station, the procedure shall be the same as explained above for 11,000-volt, except that no grounded fuse test will be made. Instead the grounding clamp on the grounding jumper will be hooked on to the end of a switch stick and touched to all three phases before the grounds are applied.

INEXPENSIVE TEST TABLE MADE FROM OLD MATERIAL

Designed for Testing Watt-Hour Meters at 110, 220 or 440 Volts and at Any Power Factor—Materials in Shop Are Used

By making a meter-test table almost entirely from old material available around the shop and using only such new equipment as was necessary to assure accuracy in testing, the Choctaw Power & Light Company, McAlester, Okla., has been able to equip its shop for conducting meter tests with very little expense. The electrical equipment consists chiefly of a States phase shifter, General Electric sign-lamp transformer, grid resistors, low-voltage transformer and switches for controlling the phase shifter and rotating standard test meter. These are supported on three 1¼-in. by 15-in. by 28-in. (3 cm. by 38-cm. by 65-cm.) slate panels supported by 1¼-in. (3-cm.) wrought-iron gas pipes. The panels had been discarded because the holes in them prevented their being used for power or lighting distribution purposes. To make the panels usable for

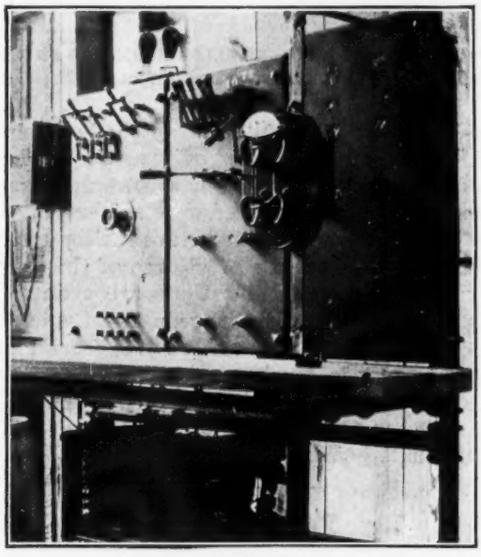
meter-test boards the holes were plugged with plaster of paris and the entire surface received a coating of black insulating paint. The busbar copper required was taken from an old generator field coil which had been wound with heavy ribbon copper. This method allowed easy bending and cutting.

The phase shifter, which is connected to a 110-volt, three-phase supply circuit through a three-pole, single-throw switch mounted on the front of the board, enables the tester to test meters at a secondary voltage of 110, 220 and 440 and at any power factor from zero to unity by steps differing by five degrees.

The load transformer in the form of a General Electric 110/11-22-volt sign-lamp transformer is connected through a two-pole, single-throw switch to one phase of the main supply circuit. All switches are mounted on the front of the board within easy reach of the operator. Directly above the load transformer switch is a red lamp which signifies when current is flowing. A green signal lamp serves the same purpose with respect to the phase shifter.

The wiring is so arranged that the phase shifter and load transformer can be used independently of each other. Two voltage terminals are provided for the neutral and each of the three secondary voltages, so that if by any reason it becomes necessary to connect additional instruments during the test it is not necessary to disturb the potential connections of the other meters.

Old street-car resistance grids are used to obtain the various current steps. These are connected across the secondary of the low-voltage transformer through a single-pole knife switch mounted on the front of the middle panel of the board. A total of twenty-five grids is required for the 5, 10, 20 and 75-amp. steps. For the two 2-amp. steps an old street-car seat-type heater was utilized. Any current value up to 40 amp.



HOME-MADE METER TEST TABLE

may be obtained in ½-amp. steps, and even closer regulation may be obtained by shifting the contact clips on the 2-amp. steps. This is done by an additional rheostat mounted on the underside of the table. When it is desired to put a full load on the service meter while the standard meter is connected for the light-load test a double-throw, single-pole switch is operated to cut out the standard meter.

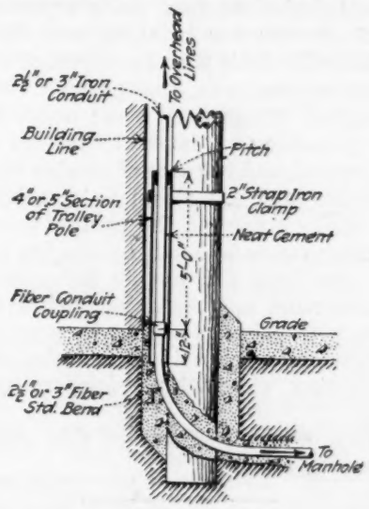
A telegraph key permits of quickly opening or closing the potential circuit of the test meter, while counting the revolutions of the meter under test.

P. M. CORDELL,
Superintendent of Meter Department.
McAlester, Okla.

PROTECTING JOINT IN CONDUIT AT GROUND LINE

Inclosed by Section of the Old Trolley Pole, the Intervening Space Being Filled with Cement and Capped with Pitch

When conduit or iron pipe carrying cables from underground circuits to overhead lines is not protected at the ground line, deterioration and possible cable failure may result. To avoid this trouble for the Sioux



CEMENT AND PITCH PREVENT MOISTURE REACHING CONDUIT

City (Iowa) Service Company the Krehbiel Company, engineer and contractor, employed the construction shown in the accompanying illustrations. The cost has been fully justified by the protection afforded.

From the manhole to the ground line fiber conduit incased in concrete is employed. Above this point to the overhead lines the circuit is protected by iron conduit. The joint at the ground line is made with a fiber conduit coupling. Around the conduit and extending from 5 ft. (1.5 m.) above the ground to 12½ in. (30 cm.) below the surface is a section of an old steel trolley pole 4 in. or 5 in. (10 cm. or 12.5 cm.) in diameter. In the intervening space, except for a few inches at the top, is neat cement. Pitch is poured in the remaining space to prevent the entrance of moisture. After this part of the work is completed the entire base of the pole is incased with concrete.

Draining Manholes and Covering Cables

Owing to the fact that the underground system of the Erie (Pa.) Lighting Company is below the level of Lake Erie, it would be continually flooded excepting for the automatic water siphons installed in a small sump pit in a free corner of each manhole. Four cables per manhole have been considered the limit here, and all are covered with concrete plaster having a heavy content of hair.

MAINTAINING TIGHT SETTINGS CUTS FUEL BANKING COSTS

Steam Raised to 210 Lb. Pressure at Start of Eight-Hour Banking Period, and All Doors Closed Tightly Thereafter

When the last generator of the Waco plant of the Texas Power & Light Company is shut down at 10:30 p.m. the boilers are filled with water to within one inch of the top of the gage glass. Fires are left burning during this time and steam pressure is raised to the "popping-off" point, which is 210 lb. (14.7 kg. per sq.cm.). The coal feed to the stokers is cut off, and all ash-pit doors are closed tightly. The boilers are then left in this condition until fifteen minutes of starting-up time, which is 6:30 a.m. Generally the steam pressure drops to 125 lb. (8.8 kg. per sq.cm.) during this period, and calculations from daily reports show that the amount of fuel for bringing one 600-hp. boiler from 125 lb. to 200 lb. is only one barrel of oil.

When this system was first adopted the engineers of this company thought that there would be considerable delay in starting up, caused by the low steam pressure, but it was found in cases of trouble the fireman is always able to raise his steam to operating pressure before the engineer can get the vacuum pumps and circulating pumps started. In this plant the fuel-banking costs were cut from $12 to $50 for each eight-hour period. This could only be accomplished by covering the settings with asbestos plastic, keeping the blow-off valves, feed-water valves and superheater drains tight and maintaining close-fitting dampers and ash-pit doors.

E. T. Keck, steam engineer of this station, is responsible for this method.

CHANGE IN WATER PIPING IMPROVES CONDENSER VACUUM

Water from Treating Basin of Power Plant Found Too Warm to Be Used as Hurling Water for Pump

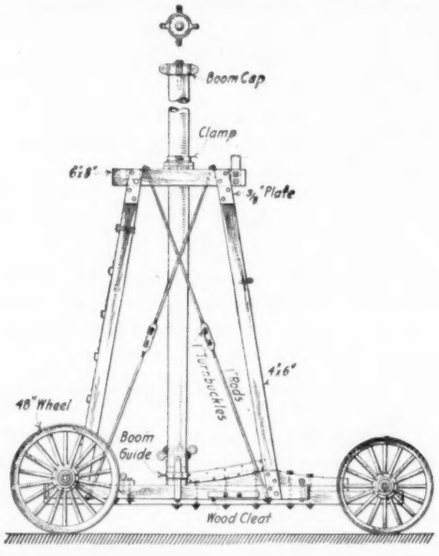
Originally the hurling water for one of the vacuum pumps in the plant of the Nebraska Power Company came from the treated water basin of the plant. This water was generally warm owing to the fact that the basin is in the sun and the water used in cooling various transformers was returned to the basin. In fact, the temperature of the water taken from the basin and used for hurling water was even higher than the temperature of the condensate which the vacuum pump sought to remove. As the efficiency of the vacum pump depends on the temperature of the hurling water, it being higher the lower the temperature is, a change in layout had to be made so that the condensate could be used for this purpose. Accordingly the piping was arranged so that the condensate drops directly to the hurling water pits, part then going to the vacuum pumps, and the remainder is delivered by an automatically operated pump to the treated boiler-feed-water basin.

The change permitted the use of hurling water that was nearly as cool as the circulating water, there being a difference of only 5 deg. Fahr. (3 deg. C.) to 15 deg. Fahr. (8 deg. C.) throughout the year between the river-water temperature and that of the condensate. The temperature of the river rises to about 86 deg. Fahr. (25 deg. C.) in the summer and falls to 34 deg. Fahr. (1 deg. C.) in the winter. Since this change was made it has been possible to raise the vacuums and thus to a considerable degree increase the efficiency of the main turbine.

PORTABLE DERRICK FOR RAISING POLES

Mounted on a Low-Hung Truck, It Has Been Found Very Successful for Raising Poles Quickly and Economically

When constructing a transmission or distribution line the problem of raising the poles is probably the most important because if poles are not raised in an efficient



FOUR-POLE WOODEN STRUCTURE ALLOWS POLES TO BE RAISED TO VERTICAL POSITION

manner, the cost of the line is apt to be prohibitive. The Public Service Company of New Jersey has constructed a derrick mounted on a low-hung truck (to be portable) which has proved very successful. It consists of a four-pole wooden structure the top cross-arms of which support a mast. At the top of this mast is a boom cap and at the bottom there are eyelets for attaching the boom. The end rope for the block and tackle is attached to the end of the boom and runs through the hole in the boom cap.

Poles can be brought to a vertical position by means of an arrangement for rotating both mast and boom about the mast bearing as a center.

Line Poles Set on Ground

Instead of digging holes for line poles, the Western States Gas & Electric Company, Eureka, Cal., has adopted the practice of setting two poles together and simply placing them on top of the ground, the poles being guyed four ways. This prevents rotting of poles at their base and therefore prolongs their life. Other companies utilizing this plan have used concrete footings, but H. L. Jackman, manager of this company, does not consider such a procedure necessary, having found the method described entirely satisfactory.

INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

QUICK-STOPPING DEVICE REDUCES DRILL ACCIDENTS

Switch Mounted Inside of Machine Automatically Reverses Series Field of Motor, Which Causes Motor to Stop

Sometimes a drill will catch in the hole being made and cause the work to swing around many times even if the power is switched off immediately. This may be attended with very serious results, so the American Car & Foundry Company has attached dynamic brakes to each of its drills which will stop rotation within a quarter revolution after power is interrupted. A small switch is attached to the handle controlling the machine in such a manner that it automatically reverses the series field and short-circuits the motor armature when the operator releases the handle.

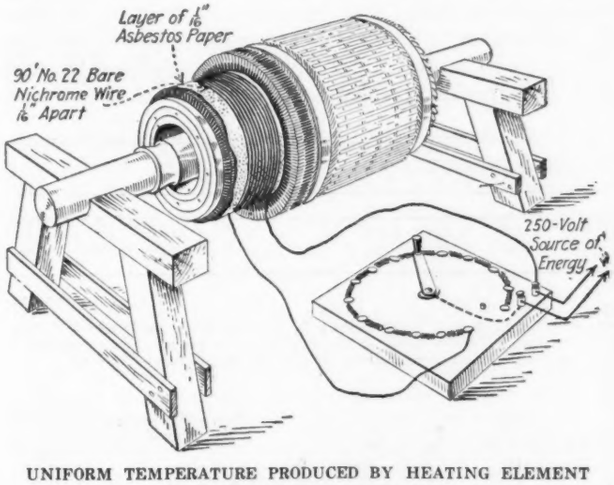
J. A. Osborn, electrical engineer for the company, devised the method of protection described.

ELECTRIC BAKING FOR COMMUTATOR INSULATION

Resistance Wire Wound Around Commutator, but Insulated Therefrom with Asbestos—Uniform Temperature is Produced

After new commutator segments have been substituted for old ones or the insulating spacers have been replaced it is usually necessary to bake the commutator in order to facilitate clamping it properly. In the past this has been done in several ways, chiefly in an oven or with blow torches, but a repairman in the Middle West developed a method which has several advantages over either method. A layer of $\frac{1}{16}$-in. (1.6-mm.) asbestos paper was wrapped around the commutator, and over it with $\frac{1}{16}$-in. spacing was wound 90 ft. (27 m.) of No. 22 Nichrome wire. Applying 250 volts to the terminals of this resistance wire produced a uniform heat in the commutator which permitted evening up the insulating segments and clamping the end rings. Ordinarily it would be advisable to have a variable resistance in series with the heating element so its temperature can be kept at a desirable value. By covering the armature after the commutator is heated in this manner varnish may be applied thereto and baked in by the heat conducted to the armature through the leads from the commutator. This method was used on a 80-hp., 550-volt motor.

ALBERT KRAUSE.
Omaha, Neb.



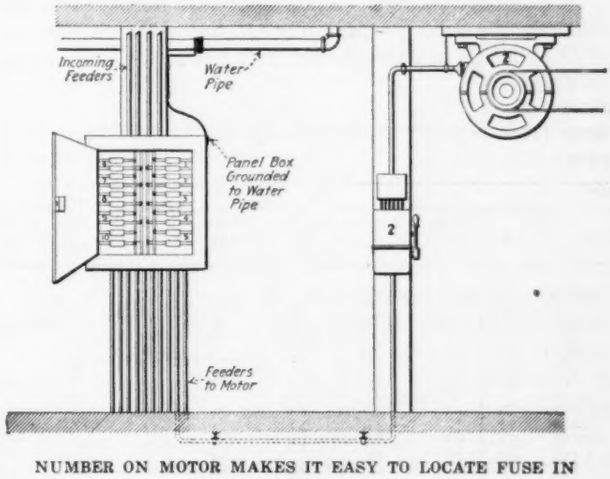
UNIFORM TEMPERATURE PRODUCED BY HEATING ELEMENT WOUND AROUND COMMUTATOR

NUMBERING SYSTEM SAVES TIME WHEN REPLACING FUSES

When Fuses Blow on Motor Operator Notifies Electrician, Giving Number of Machine, Which Signifies Position and Size of Fuse

Instead of fusing industrial-plant motors at the machine, it is the policy of some designing engineers to group the fuses for several machines at some central point. Unless some method is provided for identifying the fuses, there may be delay in locating the blown ones when a motor suddenly stops. This was taken care of in a wood shop by numbering the motors and their respective fuses.

The panel on which the fuses are mounted is 3 ft. by 6 in. by 8 ft. (0.9 m. by 15 cm. by 2.4 m.) and is fastened to a large post in the center of the shop. Four power feeders enter the panel at the top and are connected to four vertical buses. On each side of the buses knife fuses of 300, 200, 100, 60 and 30 amp. are mounted on the slate board. The various motor circuits are carried through a gutter 6 in. (15 cm.) wide



NUMBER ON MOTOR MAKES IT EASY TO LOCATE FUSE IN CENTRAL BOX

to conduits at the bottom of the panel and from there underneath the floor along the basement ceiling and up to starters and their motors.

Each motor and starter is plainly numbered to correspond with its fuse in the panel. When a motor stops the foreman informs the electrician of the number and he, by reference to a handy record, can determine the size of the fuse needed and can take it to the panel on his first trip.

The fuse panel is durable and dust-proof and by removing the whole front frame circuits may be withdrawn and replaced in short notice. Its total cost of construction was $250.

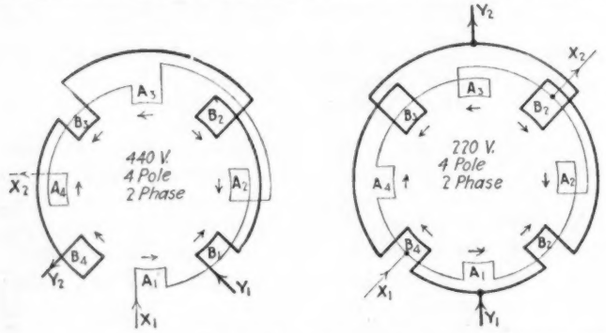
H. S. RICH.

East Berlin, Conn.

ADAPTING A MOTOR TO A DIFFERENT VOLTAGE

Only a Few End Connections in Stator Winding Had to Be Changed to Operate 440-Volt Motor on 220-Volt Circuit

Motor repair shops are continually being asked to change the connection of motors, the most common request being for a reconnection of a motor to operate



FIGS. 1 AND 2—MOTOR WINDING BEFORE AND AFTER CHANGING FROM 440 VOLTS TO 220 VOLTS

on a different voltage. Sometimes this necessitates rewinding the motor with different-size wire on account of the change in current, but it is not always necessary to do so.

The diagram of Fig. 1 shows the original connections of the motor, and Fig. 2 indicates the connection after alterations had been made. The changes were made as follows:

Terminal X_1 was joined to the beginning of coil group A_1 and end of group A_4. Then the beginnings of groups A_3 and A_4 and ends of A_1 and A_2 were connected. Terminal X_2 was joined to the beginning and end of groups A_2 and A_3 respectively. The B-phase coils were similarly connected.

The foregoing alterations give very well-distributed end windings, which are considered essential to obtain a uniform flux distribution; but the impedance of the parallel circuits will be changed if the rotor runs off center, as may happen with a worm bearing, thus causing overheating. On account of the small air gap usually found in alternating-current motors, there is small probability of this happening because worn bearings would cause the rotor to rub the stator before it would bring about overheating. Unequal distribution of current between parallel windings due to a change of impedance may be avoided by connecting the coil groups which are diametrically opposite. Of course, this cannot be done with two parallel windings if one-half the number of poles is an odd number.

SOLVENT CHART FOR INSULATING VARNISHES

Benzine Preferable to Gasoline as a Solvent, but Gasoline Can be Used — Solvent and Varnish Should Be Approximately at Same Temperature

Since varnish is usually sold in concentrated form care must be taken in dissolving to avoid wrinkles or stringy drip forming on coils when varnish is too heavy. Benzine is preferable to gasoline as a solvent but gasoline can be used. The solvent and varnish should be approximately the same temperature and neither should be under 60 deg. Fahr. (15.5 deg. C). The accompanying chart shows the percentage of 58 deg. benzine to be added to every 100 gal. (378 l.) of insulating varnish to bring it to the correct specific gravity. The most suitable gravity should be established by trial and the specific gravity kept constant at this value.

SOLVENT CHART FOR INSULATING VARNISHES

Indicating the number of gallons of 58° benzine to be added to every one hundred gallons of varnish to reduce the varnish to the desired specific gravity. Example: To reduce from 30B to 32B—8 gallons; from 0.864 Dec. to 0.843 Dec.—18 gallons.

Dec. = Decimal Scale
B = Baumé Scale

Desired Specific Gravity		Observed Specific Gravity															
Dec.	B	0.903	0.897	0.892	0.886	0.881	0.875	0.870	0.864	0.859	0.854	0.849	0.843	0.838	0.833	0.828	0.823
		25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
0.903	25	0															
0.897	26	3	0														
0.892	27	6½	3½	0													
0.886	28	10	7	3½	0												
0.881	29	14	10½	7	3½	0											
0.875	30	18	14½	11	8	4	0										
0.870	31	22	19	15	11½	8	4	0									
0.864	32	27	23	19½	15½	11½	8	4	0								
0.859	33	32	28	24	20	16	12	8	4	0							
0.854	34	37	33	29	25	21	17	12½	8½	4½	0						
0.849	35	43	39	35	30	26	22	17½	13½	9	4½	0					
0.843	36	50	46	41	36	32	27½	23	18	14	9	5	0				
0.838	37	57	53	48	43	38	33	28½	24	19	14½	9½	5	0			
0.833	38	65	60	55	50	45	40	35	30	25	20	15	10	5	0		
0.828	39	74	69	64	58	53	48	42	37	32	26	21	16	11	5½	0	
0.823	40	84	78	73	67	61	56	50	44	39	34	28	22	17	12	6	0

In one repair shop, where a 440-volt, two-phase, four-pole meter had to be changed to operate on 220 volts it was done by changing the end connections so that the number of paths through the armature would be doubled.

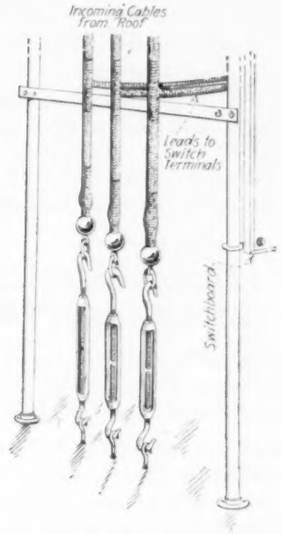
With 63 deg. gasoline 15 per cent less should be used than that shown and with 54 deg. benzine 10 per cent more should be added.

This information was taken from a chart compiled by the Dolph Manufacturing Company.

METHOD OF AVOIDING AN UNSIGHTLY INSTALLATION

Heavy Open Wiring Drawn Taut by Means of Turnbuckles—Flexible Cable Is Made to Serve for Busbars

In one plant where the incoming feeders to a switchboard had to be brought down from a high ceiling a very neat installation was made by dead-ending the



VERTICAL FEEDER RUNS DEAD-ENDED AT FLOOR WITH TURNBUCKLES

feeders at the floor with turnbuckles which were drawn up until the cables were taut and sightly as they could be made without inclosing them in conduits. Between the ends of the cables and the turnbuckles were placed ball insulators similar to those used in supporting trolley wires. Since the busbars required back of the switchboard did not have to be very long, they were made of the same kind of conductors as the incoming feeders and attached to the latter just far enough above the floor to permit of their being run horizontally past the switch terminals.

CONSTANT VOLTAGE NEEDED WITH INDUCTION MOTORS

High Reactance in Transformers and Motor Feeders Reduces Overload Capacity and Starting Torque Considerably

Since the torque of an induction motor is proportional to the square of the applied voltage, particular attention should be given to avoiding excessive drop in voltage at the motor. If the circuit is such as to give rated motor voltage at full load, the voltage at no load and consequently the exciting current are higher, while the voltage at overloads and consequently the maximum output are lower than if constant voltage were maintained. Furthermore, the starting current will be lower than it otherwise would be, thereby reducing the starting torque.

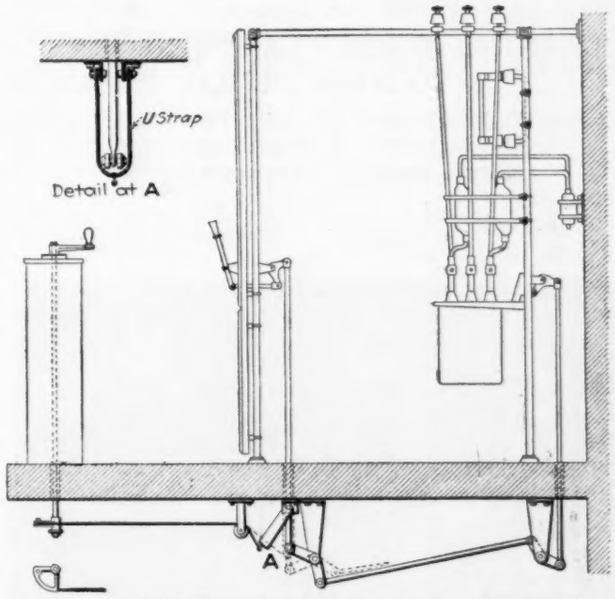
Excessive drop is sometimes caused by transformers or feeders of too high reactance (4 per cent reactance being a good value for transformers and 15 per cent a bad one), in which case the reactance should be reduced by substituting transformers with better characteristics and seeing if the circuits can be arranged to give lower reactance. Three-phase cable or three-conductor within the same conduit gives lower reactance than open-wire, and single-conductor through metallic conduit the worst of all. Excessive resistance or poor power factor may also cause trouble. The latter may often be improved by using a smaller motor and depending on its overload capacity to carry peaks if it operates underloaded most of the time.

To give some idea of the effect of high reactance on an induction motor, an example might be considered in which the transformer resistance is 2 per cent, the reactance 15 per cent, and the supply voltage at the transformer such as to give rated voltage at the terminals of a 110-volt, 5-kw. motor at full load. With the rotor short-circuited the starting torque is only one-half that with constant supply voltage. Furthermore, the maximum power which can be developed drops down almost to 80 per cent of that obtainable with constant voltage.

PLAN USED TO INTERLOCK CONTROLLER AND SWITCH

Handle of Motor Controller Is Mechanically Connected to Oil Switch to Prevent Its Being Closed Unless Controller Is in Off Position

In order to prevent the oil switch which energizes a motor circuit being closed except while the motor controller is in the off position, an interlocking device has been installed in one plant as shown herewith. The remote-control manually operated switch is connected to the circuit-breaker by means of the usual rod and bell-crank arrangement, but the mechanism is placed beneath the floor so that it cannot be tripped over. To the



CIRCUIT-BREAKER CANNOT BE CLOSED IF U-STRAP IS IN POSITION INDICATED BY DOTTED LINE

lower end of the controller shaft is attached a quadrant carrying a wire which runs over a pulley and is fastened to a hinged U-strap under the vertical rod connecting with the switch handle. Unless the U-strap is pulled away from its vertical position by the controller being moved to the off position, the switch rod cannot move downward. Therefore the switch cannot be closed if the controller is not in the off position.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Methods for Increasing the Use of Electric Light, Power and Heat

UNFORESEEN BENEFITS FROM CUSTOMER SECURITY HOLDERS

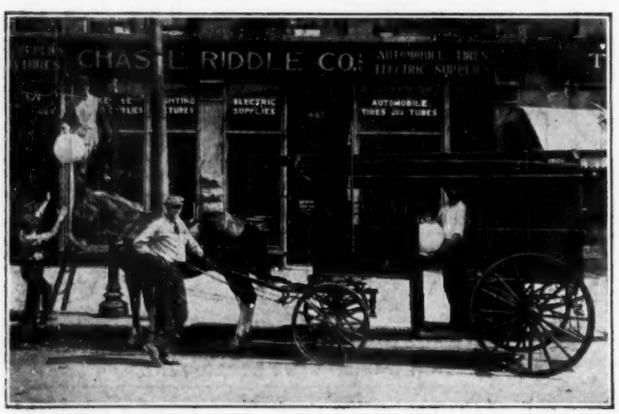
Water-Power Plant Imperiled by High Water Was Saved by Efforts of Farmers Who Proved to Be Financially Interested

The highest stage of water on record was recently experienced by the Minnesota Valley hydro plant of the Northern States Power Company. Nearly five feet of water was spilling over the dam and the tailwater rose to a depth of 9 ft. (2.7 m.), flowing into the plant through the windows and doors. Conditions were very serious when, reports C. D. Hunt, manager of the Southwestern division of the company, the farmers living in the vicinity of the plant came to the rescue and faithfully operated the pumps for forty-eight hours until other means could be employed to lower the water in the generating room of the plant. The farmers came to work at midnight and left the work on their farms for two days in order to assist in the work of saving the plant. It developed afterward that nine of the farmers who came to the rescue were stockholders in the company and they were probably instrumental to a large extent in getting the sustained help of the other farmers in the district.

CLEANING STREET LAMPS TO KEEP PUBLIC PLEASED

Globes Washed Periodically with Hot Water Carried Around in Milk Cans Filled Twice Daily—City Commends Company's Policy

In order to maintain and if possible to improve the good will of the community, the Merchants' Heat & Light Company of Indianapolis, Ind., inaugurated a new system of cleaning city street and park lighting globes last month. Two 10-gal. (38-l.) and three 8-gal. (30-l.) milk cans are mounted in a special one-horse wagon and are filled with boiling water before leaving the plant in the morning and again at noon. Three men give their time continuously to this work and the globes are all cleaned according to a regular schedule. The company inaugurated this system of cleaning the street lighting globes on its own initiative before the public began to complain and it has called forth very favorable comment from the city government.



THREE MEN ENGAGED IN WASHING STREET-LIGHTING GLOBES IN HOT WATER

NEW YORK EDISON SERVICE TO THE NEWSPAPER OFFICES

Sun, Now Getting Central-Station Energy in Its Third Building, First Closed Its Own Generating Plant in 1898

The contemplated moving of the New York *Sun*, one of the country's best-known newspapers, to its new and larger quarters in the old Stewart Building, at Broadway and Chambers Street, has brought to light some interesting electrical data. The *Sun* was one of the earliest converts to central-station service among the metropolitan journals, having closed down its own generating plant in 1898 in favor of electric supply from the New York Edison Company. By this act the *Sun* became the largest customer on the Edison mains and detailed tests were made of the supply and service there. Thus, records show that the lamps used averaged 13.7 cp., with a consumption of 4.11 watts per candlepower.

With the improved types of lamps now available the *Sun* will have a consumption of only about 1 watt per candle, thus obtaining a 400 per cent increase of lighting efficiency during the twenty-one years of central-station service. In 1898, when the *Sun* abandoned its own lighting plant, the Edison wholesale rate then in effect had a maximum price of 10 cents per kilowatt-hour, with discounts depending on consumption and use, giving a possible minimum of 5 cents per kilowatt-hour for light and 4 cents per horsepower-hour for power. With the increased lighting efficiency now available and the lowered Edison rates since 1898, the *Sun* now gets eight times as much light for every dollar expended as it did twenty-one years ago.

That the *Sun* became a genuine advocate of central-station service for newspaper use has been twice proved, for when the paper moved in 1915 to the American Tract Society Building the plant then existing there was also abandoned and Edison service contracted for. Anticipating the coming move to still larger quarters, Edison service has been adopted for the third time. Additional equipment has been ordered, including new electric melting pots for the linotype machines, while the hydraulic elevators in the Stewart Building will be electrified.

From the standpoint of the central station, it is interesting to note that all but two of New York's big news-

papers are customers of the New York Edison Company, the list of journalistic users including the New York *Times, World* (morning and evening), *Sun* (morning and evening), *Globe, Mail, Evening Post, American* and *Journal.* The *Herald* and *Tribune* buildings still maintain isolated plants, but electric supply for the newspapers concerned is protected by large "breakdown" contracts with the New York Edison Company.

HOW TO EXPLAIN CLEARLY ELECTRIC SERVICE RATES

When the Customer Wants to Know What He Is Paying for, the Central-Station Man Can Show Him if He Will Talk in Non-technical Language

"The best understanding of the fundamentals of rates can, in my opinion, be had by reducing the whole item of costs in furnishing service to the three well-recognized divisions, (1) customer costs, (2) demand costs, and (3) output costs. I am going to change these terms a little and call them (1) personal operating expenses, (2) interest costs, and (3) general operating expenses. The first three terms are just as clear to the utility man as the last three, and perhaps clearer, but if those terms were used in explaining the rates to the customer they would not be understood—and the utility man must explain. At some time or other a customer, or a score of customers, or the city authorities, or some other rate-regulating body, will compel him to explain the 'why' of his system of charges. If he does it well, they will understand and be satisfied; if he does it poorly, they will not understand, and his customers will trouble him. A man demands to know for what he is spending his money, and I believe the last three terms will assist in making utility costs more clear in the public's mind."

In this manner J. A. Whitlow, general manager of the Pine Bluff (Ark.) company, expressed his views on explanation of rates to members of the Arkansas Public Utilities Association.

"Personal operating expenses does not mean the personal expenses of the manager or any employee of the company," he continued. "It means the personal expenses of the customer, or, in other words, the expense he and no other customer puts on the company without necessarily getting any electricity in return.

"It can be explained to the customer like this: If the company line goes down the street and there is a house facing the street but not connected with the line, then that house costs the company nothing and no bill is rendered. Suppose now the inmate makes application for service and the company connects his house with the ordinary service wires and installs a meter. Immediately he begins to cost the company something merely because he is connected. In the first place there are the service wires and the meter. They begin to depreciate from the day they are installed. They cost something and there is the interest charge on their cost. A meter reader comes to the house and reads the meter. If the house is locked, he may come a second time. A bill is made out. There is the billing clerk's time and the postage. If the customer mails in a check, there is more postage returning him the receipt. The cashier or collector sits at the window to receive the money. It is necessary to send out a collector to get the delinquents to pay. Some do not pay, and there is the loss that must be made up. Occasionaliy the customer's fuse blows out and he telephones in for the troubleman. The troubleman puts in a fuse and charges nothing.

"The utility obliges the customer in many ways without any charge. The meters must be tested periodically. The meter is for that special customer and is one of these personal expenses. The bill is disputed sometimes, and the meter is tested on complaint and the wiring rung out. All these things are not producing energy or revenue; they are the customer's personal expenses. The meter has a little coil inside of it to compensate for friction. There is always some current going through this coil. This amounts to an appreciable loss in a month, and this is a customer's cost also.

"The Missouri Public Service Commission made an estimate to determine the elements entering into a minimum charge, which may assist central-station men in showing customers what these elements of customers' personal expenses are. The annual estimate is tabulated as follows:

	Per Year
Meter expense	$0.50
Commercial expense, reading meters, bookkeeping, collecting accounts	2.00
Taxes on the cost of meter and service	0.19
Interest on cost of meter and service	1.11
Depreciation on cost of meter and service	0.93
Total (39 cents per month each)	$4.73

"To this should be added the average kilowatt-hour consumption per month of minimum customers, which it has been found is approximately 2.5 kw.-hr., at the price, say, of 15 cents per kilowatt-hour, making 37 cents. This added to the 39 cents already determined gives a total of 76 cents as the average cost of service for minimum customers."

Interest charges and general operating expenses can be explained in somewhat the same manner. It will be found that the average man likes to listen to an explanation of what he does not understand, provided that it is couched in terms with which he is familiar.

ELECTRICAL RATES LOWER IN MANY PLACES THAN IN 1914

Forty per Cent of Illinois Communities of 1000 Population or More Pay Less for Electric Service than They Did Five Years Ago

The central stations of Illinois can show a concrete example of the general contention of the industry that electric rates do not increase in proportion to commodity and labor prices. Figures of the Federal Reserve Board show that the average price of commodities increased 104 per cent during the war. To be more specific, the cost of the bituminous coal in the State of Illinois increased 86 per cent. Other products used by the central station increased in about the same proportion, and wages of the employees nearly as much.

Compare these figures with the rates obtained for their service by the Illinois utilities. From official figures covering every town or city of more than 1000 population in the state, the Illinois Committee on Public Utility Information found that in 13.8 per cent of the communities the electric rates are the same now as in 1914, 40.5 per cent have lower rates to-day than in 1914, while 45.7 per cent have somewhat higher rates now. In 54.3 per cent of the communities the people are paying the same or less for their electric service than they paid five years ago.

PSYCHOLOGY IN THE SALE OF STOCK SUCCESSFULLY

Methods of Narragansett Lighting Company Secured Better Distribution of Stock After Interest and Demand Had Been Aroused

The Narragansett Electric Lighting Company of Providence, R. I., as stated in a recent issue of the ELECTRICAL WORLD, has just passed through a successful campaign to increase the number of its stockholders.

OPPORTUNITY TO PURCHASE CAPITAL STOCK

Providence, R. I., June 4, 1919.

NOTICE TO CUSTOMERS:

If you are a customer of this company or one of its subsidiary companies and do not own any of its capital stock, you now have an opportunity to purchase stock on the partial-payment plan.

The management believes it would be mutually beneficial for the community and the company if its stock could be widely distributed among its customers. To this end the company has purchased several hundred shares of its stock, and offers these at cost to those customers of the company *only* who are not already stockholders, on the following plan:

Applications will be taken until the supply is exhausted, and allotments will be made strictly in order of their receipt.

Only those who appear on the books of the company or its subsidiary companies as customers, and who are not already stockholders, will be allowed to purchase this stock.

No applications will be accepted for more than five shares.

The price is $66 per share, payable in cash, or equal quarterly payments, beginning July 1, 1919; interest at the rate of 6 per cent per annum will be allowed on installments.

Purchasers will share in any rights accruing to the stock during the partial payment period.

The purchaser may at any time receive his certificate upon payment of the balance due and the adjustment of interest and dividends.

The company was incorporated in 1884. During the thirty-four years of its existence it has an uninterrupted dividend record of 8 per cent per annum. Stock at the offering price yields 6 per cent on the investment, without considering additional rights which may accrue, and is also free from tax in Rhode Island.

Ninety per cent of the entire capital stock is now owned by residents of the territory served by the company.

As only a limited number of shares are available, should you desire to take advantage of this offer you are advised to do so at once.

Inclosed is an application blank which you may fill out and send to the treasurer of the company, room 812, Turks Head Building, Providence, where further information may be obtained.

NARRAGANSETT ELECTRIC LIGHTING COMPANY,
FRANKLIN L. HALL, Treasurer.

CIRCULAR TO CUSTOMERS URGING STOCK PURCHASE

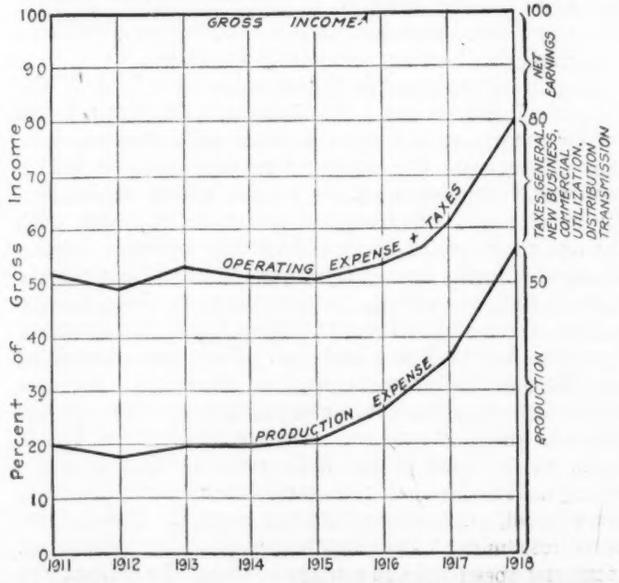
The company purchased about 4000 shares of its stock in the open market and sold them to customers of the company, either for cash or on the installment plan, at the rate of $66 per share (par value $50).

Franklin L. Hall, secretary and treasurer of the company, said in describing the details of the campaign that the number of shares any one person could buy was limited to five and any person already a stockholder was not allowed to purchase. Also, no person who was not a customer of the company could purchase. It was a surprise to the officials of the company to receive applications so rapidly that it was necessary to ask the newspaper reporters to print articles telling people that no more stock was to be had. The 4000 shares purchased originally were sold in two days after the notices were sent out, and applications covering over 1000 more shares were returned.

The campaign was carried on as follows: On May 28 reporters from the three daily newspapers were called into the office and told the news of what was planned. On the same day the stockbrokers of the city were asked to call and the plan was outlined to them. They were enthusiastic over the plan and cooperated in urging people to buy who made inquiries about the stock. On the same day circulars, the text of which is printed herewith, were mailed to each of 36,000 customers. No money was paid for newspaper advertising or for commissions. The company took chances on the attractiveness of the offer, and the people seemed to "fall all over themselves" to be the first to purchase.

The office was flooded with telephone applications and inquiries from people who were not customers and from people who were already stockholders, and many wished to purchase more than the five shares allowed. It is estimated that if the company had sold to all inquirers all the stock they asked for, 25,000 shares could have been disposed of easily. In this campaign not only was the market cleaned up of all available stock, but the total number of stockholders was increased by about 1000, and it is felt that a firm foundation has been made for future issues of capital securities. The secret of the whole campaign, it is suggested, was to make the people want the stock. The few restrictions put in the circular had the psychological effect desired, and that is what sold the stock.

The High Cost of Central-Station Living



Results of one large company's experience with increasing costs of operation are shown in the rising curves of this diagram.

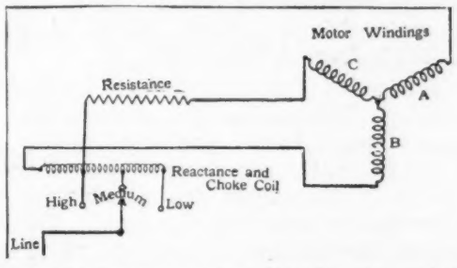
DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Speed Regulation of Motors.—E. ADLER.—The author considers the question practically from the point of view of the user and shows how the installation should be adapted to meet the needs in any particular case. The paper includes a discussion of the following questions: (1) The purposes for which a regulation of speed is desired, (2) the question as to whether changes of speed are absolutely necessary, (3) the admissibility of mechanical speed-changing devices, (4) the ranges of variation and how often they take place and for what periods of time, (5) whether nice adjustments of any kind are necessary such as absence of shocks or very precise speeds, (6) what can reasonably be expected from attendants in the case under consideration, and (7) whether it is desired that motors of normal construction should be used. All these points are dealt with and illustrated by examples from actual workshop practice. The paper concludes with a list of various types of motor, both for alternating and direct current; in each case the usual method of regulating speed is indicated.—*Science Abstracts, Section B,* April 30, 1919. (Abstracted from *Elektrot. u. Maschinenbau,* April 15, 1917.)

Development of Fan-Motor Windings.—E. W. DENMAN.—The author traces the development of the design of fan motors and discusses from diagrams of connec-



SPLIT-PHASE WINDING WITH REACTANCE AND RESISTANCE

tions the series motor, induction motor with shading coil, the split-phase motor and variations from these designs.—*Electric Journal,* June, 1919.

Effects of Short Circuits on Commutator Machines.—J. BIERMANNS.—The first case considered is that of a plain series dynamo. If there were no saturation, the current would rise according to the exponential law; the effect of saturation, however, is to cause the current curve to become flat when a certain value is reached. In the second case the field winding is provided with a diverter, and the variations of the current in field and armature windings are not necessarily in phase with each other. The author shows that if the machine is operating as a motor and the supply mains are suddenly short-circuited, the current will reverse and rise to a negative maximum before finally dying away (assuming that the speed is maintained). Under certain circumstances the current may oscillate several times after the short-circuit occurs. The third case is that of the shunt dynamo; here the current rises to a maximum and dies slowly away.—*Science Abstracts, Section B,* April 30, 1919. (Abstracted from *Archiv f. Elektrot.,* 7, 1918.)

The Numerical Solution of Equations of Transformer Dimensions.—A. R. LOW.—In a previous article the author discussed the conditions for minimum cost of a transformer with given output and loss. In the present one the author reduces the complete conditions thus obtained to a convenient form for numerical computation and many illustrative examples are worked out.—London *Electrician,* June 13, 1919.

Generation, Transmission and Distribution

Notes on Suspension Insulator Design.—H. L. GARBUTT.—The writer considers that the porosity of the porcelain body of insulators and the consequent inclusion of moisture has been responsible for the failure of a large number of insulators in the past. He discusses particularly the modification of eye-bolt designs with either the porcelain sleeve or the metal sleeve, stating that the metal-sleeve design apparently resists changes of temperature better than the porcelain sleeve.—*Journal of Electricity,* July 1, 1919.

Operation at Holtwood.—CHARLES H. BROMLEY.—A discussion of the procedure and precautions used in starting and stopping the large main turbo-alternator units. Some oscillograms are presented showing good and poor synchronizing.—*Power,* June 24, 1919.

Supply and Tariffs for Electric Heating of Rooms.—This is a joint report by the S. E. V. committee on cooking and heating apparatus and the V. S. E. committee on tariffs. The general position in the heating field is reviewed and the arguments for and against electric heating from hydroelectric networks are discussed. Although there is sufficient water power in Switzerland to cover lighting, power and traction requirements, with a good margin for electrochemical and heating purposes, there is not enough to replace all imported fuel. Relatively large amounts of power are needed to develop comparatively small quantities of heat, and the reserve of water power is low when the demand for room heating is greatest. So far as possible only off-peak energy should be used for electric heating, and the latter should be used first where it can replace most fuel. There is a favorable opportunity for electric heating in spring and autumn, water power being then plentiful and coal heating at reduced capacity being efficient. In the winter coal heaters should be used if the available water power can be better applied in other service. By aid of thermal storage hydroelectric energy may be utilized during the night and the midday hour, but if there is ample water storage available it pays better to store water during off-peak periods for use by day. The concluding section of the article discusses various tariffs for heating and makes definite recommendations to suit circumstances

and various classes of heating.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Schweiz. Elektrot. Verein, Bulletin* 10, January, 1919.)

Chart for Boiler-Test Results.—HERBERT B. REYNOLDS.—In working out the results of boiler tests lengthy calculations are required for the determination of evaporation per pound of fuel. The equivalent evaporation of the boiler horsepower may be dispensed with and the result found directly from a chart which is presented by the writer of this article.—*Power*, June 24, 1919.

Dee Hydroelectric Development.—Report on the practicability of developing the water power of the River Dee for the generation of electrical energy for agricultural purposes, by S. E. Britton, city electrical engineer of Chester. The discharge of the stream is approximately 30,000 cu.ft. (840 cu.m.) per second during a considerable portion of the year and heads of from 7 ft. (21 m.) to 37 ft. (11.3 m.) may be rendered available. Among the conclusions arrived at are: (1) The river from Llangollen to Chester is eminently suitable for development of low-fall water power, which can be economically utilized for the generation of energy. (2) Water power of the Dee contains the basic means of providing electrical energy at a cost which would be a boon to industrial and domestic life and give facilities and conveniences of a magnitude which would surpass the greatest hopes from any scheme hitherto promoted for the general improvement of such a district. (3) Electrical energy from the water power of the Dee is capable of resuscitating derelict industries and occupations, providing vital facilities for the encouragement of new industries, and also of providing power for transport, lighting thoroughfares, &c. (4) The scheme if carried out need not be harmful to any of the interests now generally enjoyed by the public. (5) The necessary works do not involve difficult or costly engineering.—London *Electrician*, June 6, 1919.

Waste-Water Turbines.—H. BAUDISCH.—The energy in the effluent water of turbines can be utilized in waste-water turbines. If H = fall in meters and c_s = velocity of outflow from suction pipe in meters per second, the effluent energy hitherto wasted is $h = c_s^2/2g$. According to the construction and speed of the turbine, h may be from 5 to 15 per cent of H. The waste-water turbine being connected behind the main turbine, the construction problem is to build a compound turbine dividing the fall very unequally. Axial, radial or axial-radial turbines may be used, and there is no restriction on the construction of the turbines, the shaft length or the method of building in. The only stipulation is that both turbines be full-stream machines. However, though there is no difficulty in building turbines for the same flow under different heads, it is very difficult to obtain the same speed in both cases. The problem is simplified if the turbine speeds be different and, say, a belt transmission be used to allow for this. A gain in power from 5 to 10 per cent is obtainable by the use of waste-water turbines, the only additional investment being the cost of the latter.—*Science Abstracts, Section B*, April 30. (Abstracted from *Zeits. Ges. Turbinenwesen*, Nos. 16, 17 and 18, 1918.)

Traction

Leakage Current from Electric Railways in Mines.—K. ALVENSLEBEN.—Tests were carried out in the Dortmund district to determine what risks were due to leakage current from electric railways in mines. Energy is supplied from a three-phase network at 1000 volts to 5000 volts through cables to an underground converter station which feeds the 220-volt trolley system. The 50-sq.mm. to 80-sq.mm. overhead wire is attached to insulators fixed in the roof, and the rails (16 kg. per m.) which form the return circuit lie on wood or iron sleepers placed on the roadway with boiler-ash packing. There is a damp, clayey mass impregnated with coal dust against the rails. The rail joints are bonded (but the bonds are merely intact) and the rails are also cross-bonded. In order to secure maximum safety it is recommended: (1) That the rail joints and especially points and crossings be bonded and that cross bonds be provided between the rails; (2) pipes, cable armoring and signal wires should be bonded to the rails at all branches and at the ends of the track, and at other points not more than 250 m. apart; (3) ignition lines, where the rails are used for current return, should be erected separately and in clear view on suitable insulators and so arranged that they cannot touch any metal parts.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Gluckauf*, 52, Nos. 44 and 45, 1916.)

Car Performance from the Engineer's Office to the Track.—C. W. SQUIER.—It is said that there is remarkable agreement between the performance data of railway motors and the theoretical curves calculated before the motor has been designed. A number of tests are given to show just how closely they agree with the curves which were plotted in advance of the design of the motor.—*Electric Railway Journal*, June 21, 1919.

Installations, Systems and Appliances

Design of Large Induction Motors.—H. L. BARNHALDT.—The author enumerates the advantages of electric drive in steel mills and in particular discusses the operating requirements and design of a 7000-hp. induction motor driving a 160-in. (4-m.) plate mill at Gary.—*Electric Journal*, June, 1919.

Electrification of Paper Mill Finishing-Room Machinery.—W. T. EDGELL, JR.—The consumption as well as the cost of paper have advanced so rapidly during the past few years that paper manufacturers are being forced to study thoroughly the possibilities of increasing production and reducing costs. The author points the way to a number of economies which are well worth serious consideration.—*General Electric Review*, May, 1919.

Electricity Versus Gas in Regard to Coal Conservation.—HUGH M. GOODY.—In a recent lecture before the Society of Arts, Sir Dugald Clerk, as a result of his calculations, concluded that there is no case for electricity in the production and distribution of heat energy. There is a case in strong competition with gas for illumination, and as against the average reciprocating steam engine of the country the advent of the steam turbine of high efficiency shows a distinct advantage. The author discusses the figures presented by Sir Dugald Clerk and concludes that while at the present time electricity cannot be said to be ready for general application for heat distribution, it would seem that it has already done so much in certain departments that it is likely to be extended to others at no very distant date.—London *Electrician*, May 23, 1919.

The Ventilation of Coal Mines.—H. W. CHADBOURNE.—Coal mining is attended by the liberation and forma-

tion of various gases which are injurious to the health of the workmen and animals and are violently explosive under certain conditions. The chemical and physical characteristics of these gases developed in coal mines are described in the first section of this article; the natural and mechanical methods of ventilation in the second section, and the electric motor-driven fan equipment and air courses in the third and concluding section.—*General Electric Review*, May, 1919.

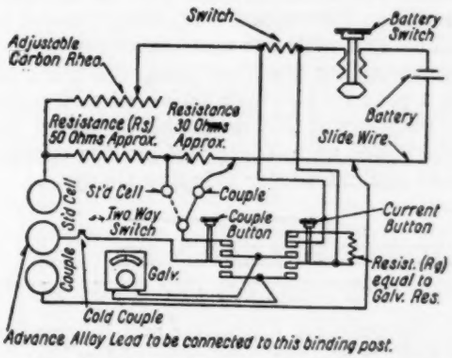
Large-Capacity Circuit Breakers.—H. G. MACDONALD.—The writer discusses a recently designed 15,000-volt, 1600-amp. circuit breaker of 23,000 arc amperes in capacity. The entire circuit breaker is built on a single heavy steel frame. The operating mechanism, closing solenoid toggle levers, trip mechanism, accelerator and magnet cut-off device are on the fore part of the top of the frame. The levers come into the circuit breaker in the rear of the operating mechanism, passing through the base into the oil tanks suspended beneath. The oil tanks are cylindrical in form with round bottoms and are pressed from a single piece without seams. Heavy tie bolts and steel cradles suspend the tanks directly from the steel frame.—*Electric Journal*, June 1919.

Electric Welding: Its Theory, Practice and Application.—H. S. MARQUAND.—In this number of the series the author discusses electrode holders and various protective coverings for the workmen. He advocates particularly leather aprons and leather gauntlet gloves to prevent burning. In dealing with protective headgear the writer advocates the use of three layers of glass, the outer layers of ordinary clear glass to protect the inner screens from the heat of the arc and from flying pieces of hot metal. The second layer should be of the green amber tint, and should be selected with respect to its opacity to ultra-violet light. The third layer should be of a neutral tint with sufficient density of color to reduce the intensity of the light of the arc to a comfortable degree.—London *Electrician*, June 6, 1919.

Ignition of Explosive Gases by Electric Sparks.—J. D. MORGAN.—The author considers the number of layers N per magnet coil and finds that the energy required to produce spark ignition is not always given by N^2t^2. Varying the magnetic conditions by experimenting with (a) air-core coils, (b) open-iron-core coils, (c) closed-iron-core coils, and interrupting the current by a flick contact breaker (consisting of a rotary steel prong and a fixed steel stem), he finds the N^2t^2 required for ignition to be constant, though not of the same value, for (b) and (c) but not constant for (a). Combining a bridge with a ballistic galvanometer, he observes that the energy associated with the system prior to interruption is constant for each group but different for different groups.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Chem. Soc. Trans. 115*, January, 1919.

Units, Measurements and Instruments

Temperature Indicator for Alternators.—S. L. HENDERSON.—It is said that in most types of ventilation, excepting those which admit air at the center of the machine, the buried copper midway between the ends will be the hottest. The author discusses the two general methods, viz., the exploring coil and the thermocouple method of determining what the temperature may be. He states that in laboratory tests the detectors have been put directly against the copper bars, but this cannot be recommended for practical testing on account of the possibility of dangerous voltages in the testing circuit. The details of making up exploring coils are discussed. The author states that exploring coils are expensive to make on account of the number of turns of small wire and on account of the amount of testing and adjusting required to secure proper resistance. They are also subject to short circuit and open circuits when placed in the machine. In the case of thermocouples these are made by welding copper and "advance" (nickel-copper) alloy ribbons together. These ribbons are ordinarily 0.005 in (0.13 mm.) thick, 0.25 in (6.3 mm.) wide and of any desired length. The couple is insulated with mica and micarta paper to withstand temperatures of at least 150 deg. Centigrade. With a difference of 1 deg. Centigrade between the temperature of the hot and cold couples, the difference in emf. is approximately 40 micro-volts. For measuring such small voltages the potentiometer methods are in general most useful since they require no outside source of current. The writer states that either the exploring coil or thermocouple methods if properly installed will give



SCHEME FOR TEMPERATURE MEASUREMENT BY THERMOCOUPLE

satisfactory results. The thermocouple method should give nearer the maximum measurable temperature as it indicates the temperature at a spot while the exploring coil gives the average temperature over its length. There is another advantage in the thermocouple method in that it is self-contained and requires no external source of voltage, and is fully as easy to operate as either of the exploring coil devices.—*Electric Journal*, June 7, 1919.

Circuit of the Current Transformer.—FRANCIS J. GILLOOLY.—The writer discusses some of the severe conditions under which current transformers operate. He points out that the ratio of transformation is affected by all changes in secondary circuits. He also describes ammeter switches by means of which one ammeter may serve to measure the current in any one of three phases. The function of current transformers in connection with relays is also taken up.—*Electrical Review*, June 7, 1919.

Telegraphy, Telephony and Signals

New High-Power Naval Radio Stations at San Diego, Pearl Harbor and Cavite.—L. F. FULLER.—The new high-power Federal-Poulsen arc stations of the United States Navy are briefly described. The motor-generator sets, temperature rises, field excitation and operating characteristics are described, and details are given of the arc converter, antenna loading inductance and wave-changing switch.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Inst. Radio Eng. Proc.*, February, 1919.)

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

TAUNTON (MASS.) MUNICIPAL PLANT TO USE FUEL OIL

Expenditure of $30,000 Authorized for Installation of Oil-Burning Equipment—Estimated Saving Over Coal Consumption Is $40,000 Annually

The Municipal Council of Taunton, Mass., has approved an expenditure of $30,000 for the installation of oil-burning equipment in place of the existing coal-burning furnaces.

Warren B. Lewis, consulting engineer, Providence, R. I., has recently taken over the management of the plant, and has determined that, with present prices of coal and oil and with due accounting for labor requirements in handling the two fuels, the plant will save $40,000 a year by the installation of oil-burning apparatus. Barges will deliver the oil by water, and tanks will be provided permitting two' months operation as a safeguard against winter shipping tie-ups.

PRESIDENT BALLARD TO MEMBERS OF THE N. E. L. A.

Asks for Suggestions, Questions and Advice Helpful to Others So that Association May Be of Utmost Value

President R. H. Ballard of the National Electric Light Association has sent a letter to members asking for suggestions that will help to make the association of constant and greater usefulness to members.

"In again actively taking up expansion and development in our industry after the restrictions of the war period," says Mr. Ballard, "we are called upon to face many new problems and we will agree that the necessity for interchange of thought and coöperation along constructive lines is greater now than at any previous period in our history.

"The National Electric Light Association is in a position to be quite helpful to all member companies along these lines. Each company in its operating experience has gained certain knowledge or information which might be of value to some companies in other areas, and each company has problems which it is striving to solve, the solution of which may be helped by the experience of other companies."

Mr. Ballard expresses his desire to make the association during the year of the present administration a clearing house for information regarding these problems. He asks for answers to the following:

Have you any suggestions to make which might aid in carrying out our desire to be of service?

Have you any problems concerning which you would like information which might help in their solution?

What suggestions can you offer resulting from your experience which might benefit other companies in the conduct of their affairs?

"It is expected," Mr. Ballard adds, "that the committee work will be very active during the year, and we shall need your assistance and advice as well as the assistance of some of your best men. I urge upon you the importance of this work, with the suggestion that all men who may be selected for committee work be encouraged to give the subjects studious consideration and that the necessary time and expense be allowed for the attendance of these men at committee meetings during the year.

"We are trying to plan active, helpful work during the year and have this work culminate in a convention program which will be the product of the best minds connected with the National Electric Light Association and result in a permanent benefit to the industry."

ELECTRIFICATION OF CHICAGO RAILROADS MADE POSSIBLE

City Council Passes Ordinance Favorable to Lake Front Improvement of Illinois Central After Eight Years of Negotiations

It is confidently expected that the electrification of the Illinois Central and Michigan Central railroad companies' property in the city of Chicago will soon be brought about as the result of an ordinance passed by the City Council this week. This is the outcome of an agreement between the Illinois Central Railroad, the Chicago South Park Commissioners and the city of Chicago which was reached only after eight years of negotiation. Had the interested parties agreed on a course of action when the improvements were first proposed, the public would probably be enjoying the benefits of electrification now and at a considerably lower cost.

This entire lake front improvement and reclamation project involves an expenditure of about $118,000,000, of which the electrical installation is estimated to cost $23,500,000.

The Illinois Central Railroad officials figure that it will cost $8,000,000 to electrify the suburban service, that $3,200,000 will be required for the through passenger service and $1,500,000 for the electrification of the freight and other services. The Michigan Central installation will probably cost about $1,800,000.

The ordinance is devoid of technical details which might hamper the railroads in the choice of their electrical equipment, nor is any method specified for applying the energy to the trains. The ordinance permits the use of any motive power the operation of which is not accompanied by the emission of smoke, steam and cinders, noxious gases or by noises more objectionable than those produced by electrical operation. The only operating requirements are that reasonable, practicable and efficient methods and devices must be used for overcoming interference with telephone, telegraph and other circuits, and that the methods recommended by the

American Committee on Electrolysis be used to prevent damage to water pipes and so forth.

Within sixty days after the ordinance becomes effective the railroad company is required to commence the preliminary work of reconstruction, and two years later work should commence on the electrification proper, so that electrical operation of the different classes of service will begin at the time scheduled. The operation of the entire suburban service must commence seven years after the ordinance becomes effective. All the freight service north of Twelfth Street is given three years' longer time. The entire freight service east and south of the Twelfth Street terminal need not start operating electrically for fifteen years, and twenty years may elapse before the entire through passenger service is operated electrically.

There is nothing in the ordinance to prevent other railroads not operating by electricity from entering and using the tracks of the Illinois Central Railroad for the purpose of using its passenger terminals or for the interchange of freight. If other companies using the Illinois Central's electrified tracks operate more than 20 per cent of the total number of through trains by steam, then the Illinois Central is not compelled to operate its through passenger service by electricity until the other railroads have to do so too. This exception does not apply if less than 20 per cent of the total number of passenger trains are operated by the steam locomotives of other companies.

The ordinance will become effective when it shall have been signed by the Mayor of Chicago and accepted by the railroad companies and by the South Park Commissioners of Chicago, and after it has also been approved by the Secretary of War and the Director-General of Railroads. Inasmuch as practically all differences were eliminated before the ordinance was taken out of committee, it is expected that it will be signed in the time allowed, which is six months for the railroads, six months for the South Park Commissioners and three years for the federal authorities. When accepted by the different interests specified in the ordinance it becomes a contract between the South Park Commissioners, the railroad companies and the city of Chicago.

CZECHO-SLOVAK COMMISSION IS TOURING UNITED STATES

Members of Technical and Mercantile Commission Representing the New Republic in Europe Are Studying Water Power and Control

George Otis Smith, Director of the Geological Survey, recently received in Washington members of a technical and mercantile commission representing the Czecho-Slovak Republic.

This commission is touring the United States, investigating water power, methods of flooding control, hydraulic-fill dams and methods of irrigation. The itinerary will include visits to Niagara Falls, Dayton, Ohio, Keokuk, Iowa, and Albany, N. Y. At the last-named place the members of the commission will inspect the New York State Barge Canal.

It is expected that this commission will be followed by others which will make a detailed study of the subjects in which it is interested, with the view of applying the information obtained in the carrying out of similar projects in the Czecho-Slovak Republic.

DAYLIGHT SAVING AS OUR CONGRESS LOOKS AT IT

Another Attempt to Repeal Legislation Defeated in the House of Representatives—Senate Has Bill Before It to Annul the Law

Another attempt in the House to repeal daylight saving through a rider to the 1920 agricultural appropriation bill was defeated last week, when forces joined to eliminate the repeal provision from the bill. Members opposed to inserting the repeal provision gained strength with each vote in the House, the final poll being 203 to 171.

The Senate now has before it a House bill to repeal the daylight-saving law. The Senate may pass this repeal bill and send it to the President for ratification. In view of the fact that President Wilson vetoed the agricultural appropriation bill because of the daylight-saving rider, it is not believed in Washington that he will consent to a separate repeal measure.

SMALL MUNICIPAL PLANTS BUYING TRANSMISSION SERVICE

Cities Which Formerly Operated Electric Lighting Properties Are Finding that Coal Costs Make Purchase of Energy Profitable

The increased cost of coal has driven a number of cities, particularly in the Middle Western States, to consider the probable economy of shutting down their steam-operated central-station plants and buying electrical energy at wholesale from nearby transmission companies. Among the cities which are following this plan are:

Muldrow, Okla.	Eugene, Ore.
Hanover, Ill.	St. Peter, Minn.
Cuba City, Wis.	Gaylord, Minn.
Lodi, Cal.	Shakopee, Minn.
Priest River, Idaho.	Fairmont, Minn.
St. James, Minn.	Chaska, Minn.
East Grand Forks, Minn.	Rocky Ford, Col.
Delano, Minn.	Swink, Col.
Anoka, Minn.	Kasson, Minn.
Fowler, Col.	Dysart, Iowa.
Waseca, Minn.	Garrison, Iowa.
Dike, Iowa.	Midway, Ky.
Newton, Iowa.	Sandwich, Ill.
Winthrop, Iowa.	Palestine, Ill.
Somerset, Ky.	Clayton, Ill.
Hickman, Ky.	Girard, Ill.
Table Grove, Ill.	Goodland, Ind.
Findlay, Ill.	Doniphan, Neb
Kansas, Ill.	Shelton, Neb.
Buckley, Ill.	Clarks, Neb.
South Stillwater, Minn.	Wood River, Neb.
Hazel Green, Wis.	Central City, Neb.
Brenton, Wis.	

Coal costs in some of the small plants of the Middle West have been ranging from 2.5 cents per kilowatt-hour to 5 cents per kilowatt-hour and higher during the last year. This has discouraged steam-plant operation. Moreover, when the plants reach a condition where renewal is necessary this also affords another opportunity to the smaller cities to investigate. Such a case recently came up at Fairmont, Minn. The city officials here decided to spend $90,000 for station additions and changes, but when it was found that these would cost $150,000 the idea was abandoned and power was purchased from the Northern States Power Company.

CONTRACTORS' ASSOCIATION TO COÖPERATE WITH LABOR

Approves Principles Suggested by Conference Club—Labor and Merchandising Discussions Close Milwaukee Convention

A lively discussion of the labor question and the results of giving official recognition to labor bodies in the electrical field marked the closing sessions of the Milwaukee convention of the National Association of Electrical Contractors and Dealers last week. The resolution, which aroused vigorous opposition and defense, authorized the executive committee of the association to "act as it may deem best" in applying the principles below enunciated in establishing relationship with the International Brotherhood of Electrical Workers. The "declaration of principles" finally approved by the convention late Friday afternoon follows:

DECLARATION OF PRINCIPLES

PREAMBLE

The vital interests of the public and of employee and employer in industry are inseparably bound together. All will benefit by a continuous peaceful operation of the industrial process and the devotion of the means of production to the common good.

PRINCIPLES

1. The facilities of the electrical industry for service to the public will be developed and enhanced by recognizing that the overlapping of the functions of the various groups in the industry is wasteful and should be eliminated.

2. Close contact and a mutually sympathetic interest between employee and employer will develop a better working system, which will tend constantly to stimulate production, while improving the relationship between employee, employer and the community.

3. Strikes and lockouts are detrimental to the interests alike of employee, employer and the public, and should be avoided.

4. Agreements or understandings which are designed to obstruct directly or indirectly the free development of trade, or to secure to special groups special privileges and advantages, are subversive of the public interest and cancel the doctrine of equality of rights and opportunity, and should be condemned.

5. The public interest is conserved, hazard to life and property is reduced and standards of work are improved by fixing an adequate minimum of qualifications in knowledge and experience as a requirement precedent to the right of an individual to engage in the electrical construction industry, and by the rigid inspection of electrical work, old and new.

6. Public welfare, as well as the interests of the trade, demands that electrical work be done by the electrical industry.

7. Coöperation between employees and employers acquires constructive power as both employees and employers become more completely organized.

8. The right of employees and employers in local groups to establish local wage scales and local working rules is recognized, and nothing herein is to be construed as infringing that right.

For fifteen years the national association has avoided entering into labor subjects, and spirited discussion in both convention sessions and meetings of the executive committee preceded the adoption of the resolution. W. I. Gray of Minneapolis intimated that recognition of the union would force open shops in the electrical industry into the control of the union. A. L. Oppenheimer, Cleveland, opposed the measure as favoring the interests of the larger contractors against those of the smaller contractors not represented at the convention. L. K. Comstock, New York, James R. Strong, New York, and others urged consideration of the resolution "on its merits as a document" rather than on what might be impugned against it. "Not to deal with labor is to promote bolshevism and anarchy," declared W. L. Goodwin. "Only men criminally blind to the welfare of humanity would oppose closer relationship between employers and employees." Following Mr. Goodwin's speech, the motion was passed by a majority vote.

As originally presented to the executive committee by the advisory committee of the national association (which is made up of members of the Conference Club) the resolution contained the following provision:

"A tribunal should be created with power to decide all questions that may arise between employees and employers represented by the signatories hereto that otherwise might result in interruption of work, loss of wages, loss of capital, and consequent loss and inconvenience to the public."

Under the heading of "Agenda," or "duties," later also omitted, the original resolution in detail outlined the plan for a "national executive council" to carry out the proposed coöperation between the public, employees and employers, already described in the ELECTRICAL WORLD of May 10. This council, it was proposed, would consist of five representatives of the International Brotherhood and five representatives of the national contractors' association, and would hold open meetings four times a year, or oftener if necessary.

After long discussion in the executive committee meetings, the paragraph providing for the "tribunal" and the "Agenda" outlining its operation were omitted from the resolution presented to and passed by the convention body.

Being given power to act as it deems best to apply the principles of the resolution, the executive committee later moved to form a committee of five to "discuss these principles with representatives of national organized labor," and if the principles are adopted by national organized labor, the committee is authorized to confer with a committee of organized labor for the purpose of bringing about a general application of the principles. It is stipulated, however, that the committee can take no action without express permission of the executive committee.

Discussion of the labor resolution followed a thoughtful address on "Human Relations in Industry" by Dr. H. C. Metcalf of the Bureau of Industrial Research, New York City. "Growth in the capacity for and development in the habit of coöperation are the surest possible test for the advancement of civilization," quoted Dr. Metcalf. The social inventions and methods which we are on the eve of, as a result of coöperation, will contribute more wealth to mankind, he thought, than all the mechanical inventions of the past generation have done.

MERCHANDISING SESSION

At the Merchandising Section session of Friday John G. Learned, chairman of the Commercial Section, National Electric Light Association, invited all contractors to coöperate in the N. E. L. A.'s campaign for more outlets. P. Polachek, Milwaukee, discussed the layout and conduct of a retail electric store. J. R. Tomlinson, Portland, Ore., spoke on the retailer's relations with the public, and A. L. Oppenheimer, Cleveland, talked on the sale of lighting fixtures.

At the Apparatus Section meeting, conducted simultaneously, A. Penn Denton, Kansas City, described efficiency methods in the repair business; A. O. Kuehmsted, Gregory Electric Company, Chicago, described methods of determining the value of burned out apparatus, and C. M. Jamison, Milwaukee Railway & Light Company, read a paper on appliance repairs.

The convention voted to abolish the classification of "members-at-large" and to make the minimum dues $7.50 a year. The cost of operating the association is now $28 per member per year, while the dues average $11 per member, from all classes. The next annual convention will be held at Baltimore the week of Oct. 6, 1920.

CENTRAL STATIONS HAVE BEST FUTURE AMONG UTILITIES

Attorney Eagleson Points the Way to Ohio Electric Light Association—Committees Do Valuable Work—C. H. Howell Elected President

In an address before the Ohio Electric Light Association Freeman T. Eagleson, former attorney for the Public Service Commission of Ohio, said that light and power companies have a better future before them than the other public utilities. All utilities must submit to public regulation because their property is put to uses in which the public has an interest. Mr. Eagleson did not think this was anything to be afraid of, however, provided that the utilities taught the public the truth about their problems and treated the people fairly.

Other sessions of the Ohio association's convention at Cedar Point, Ohio, were reported in last week's issue of the ELECTRICAL WORLD. One of the most important committee reports presented to the membership was on illumination. It showed that the correspondence course started early in the year to teach the commercial and elementary technical aspects of industrial lighting has been successful. The course has not only been taken up by central-station men, for whom it was primarily instituted, but the lessons have been found profitable by electrical contractors and others responsible for industrial lighting.

Believing that the course would carry more weight if it were not published in the name of the lighting industry, the committee arranged with Ohio State University to carry on the course as a university extension movement. The price, fixed to barely cover the cost of printing, is $2, and this encourages those who need it most to take up the work.

In order to stimulate the students in their work the National Lamp Works of the General Electric Company gave a foot-candle meter to the central-station student who obtained the highest percentage for the first six months of the course. Prof. F. C. Caldwell, Columbus, chairman of the committee, announced that the prize had been won by G. H. Ahlborn of the Ohio Electric Railway Company, Zanesville. In addition, Charles W. Ward of the Columbus Railway, Power & Light Company and G. H. Purdy of the Springfield Light, Heat & Power Company also did commendable work and received honorable mention.

In discussing the committee's report S. E. Doane, Cleveland, said that if lighting intensities were brought up to the proper values the lighting consumption of energy would be tripled. George Stickney, Harrison, N. J., said industrial lighting is the most undersold part of the electrical business. In some investigations he was called upon to make Mr. Stickney found that factories with isolated plants usually had better illumination than the central-station customers. The report was also discussed by W. A. Durgin, Chicago; G. S. Merrill, Cleveland; D. L. Gaskill, Greenville, and W. A. Wolls, Columbus.

AUTOMATIC SUBSTATIONS FAVORED

A decided leaning toward automatic substations was shown in the discussion on the transmission and distribution committee's report, submitted by the chairman, R. R. Krammes, Newark, Ohio. H. L. Wallak, Cleveland, pointed out that the advantages of automatic substations grow with the frequency and magnitude of labor troubles. H. R. Summerhayes, Schenectady, N. Y., said that not only substations but hydroelectric generating stations were being successfully controlled automatically. Speaking of some of his trouble experiences, Mr. Summerhayes said that flashovers seldom occur at insulators or terminals on a system where the neutral is grounded and when flashovers are experienced the grounding of the neutral usually stops the disturbances. Among others who discussed different phases of the report were G. B. McCabe of Detroit, M. E. Grah of Toledo, F. C. Caldwell of Columbus, C. H. Howell of Coshocton, and Ivor L. Kentish-Rankin of Chicago.

"The Trend of Socialism" was the subject of an address delivered by F. G. R. Gordon of New York, who had just returned from an investigation of labor conditions in Winnipeg, Canada.

The officers elected for the ensuing year were: President, C. H. Howell, Coshocton; vice-president, F. H. Golding, Canton; secretary-treasurer, D. L. Gaskill, Greenville. The members of the advisory and finance committees were reëlected, and D. I. Hard, Wooster, was added to the executive committee

ELECTRICAL DAMAGE IN THE MINNESOTA CYCLONE

Fairly Large Proportion of the $4,000,000 Damage Caused by the Storm Rests Upon Public Utility Companies

It is estimated that the total loss caused by a cyclone which visited Fergus Falls, Minn., on June 22 was $4,000,000. In addition to this there have been fifty-seven deaths resulting from the storm.

The Ottertail Power Company's loss will be in the neighborhood of $4,000. This company was particularly fortunate in that none of its power plants or substations was in the path of the storm, the items of loss being confined entirely to the 40,000-volt transmission lines, power circuits, customers' meters and loss of business. The city of Fergus Falls owns the distribution lines for furnishing light and cooking service within the city. Its loss was very heavy and service has not yet been restored in some of the more remote parts of town. None of the employees of the Ottertail Power Company was injured in the cyclone, although a number of them, including the general superintendent, W. J. Sorgensen, and A. V. Taylor, an electrical engineer, had very narrow escapes and were rendered homeless.

The loss suffered by the local telephone company will amount to about $80,000.

SOUTHERN CALIFORNIA EDISON COMPANY ENLARGES HOLDINGS

Purchases Shaver Lake Watershed in the Sierras, Increasing Its Hydroelectric Resources by 30,000 Hp. and Extending Lake Huntington Development

On July 16 the Southern California Edison Company received authority from the Railroad Commission of the State of California to guarantee $1,150,000 5 per cent serial bonds to be issued by the Shaver Lake Lumber Company, a subsidiary corporation. The purchase price of the property was $1,400,000, $250,000 of the amount being paid in cash. The original owner of the property was the Fresno Flume & Lumber Company, the Shaver Lake Lumber Company having been formed to take over the business as an Edison subsidiary.

The property consists of 30,000 acres (12,140 hectares) of timber land, saw mills, flumes and plants at Shaver Lake, in the High Sierra Mountains of central California. The water in Shaver Lake has been used to float lumber through a flume line to Fresno, a distance of approximately 60 miles (96 km.). This water will hereafter be used to develop hydroelectric energy, and the lumber will be transported by some other means.

Through the purchase of this property the Southern California Edison Company secures a large natural reservoir site. This is in reality an extension of the Huntington Lake development and is an important factor in the program of the company to ultimately develop 500,000 kw. of hydroelectric energy in this watershed. The following significant paragraph is extracted from the Railroad Commission's order in this matter:

"The Railroad Commission hereby declares that present and future public convenience and necessity require the acquisition for purposes of a reservoir site and in hydroelectric power development by the Southern California Edison Company of certain properties now owned by the Fresno Flume & Lumber Company."

In connection with the Shaver Lake development it is proposed to construct a dam and the necessary tunnels to connect the reservoir with the existing plant No. 2 on Big Creek, with the result that the output of this plant will be substantially increased without any increase in the generating units and capacity of transmission lines. The additional water supply will also be available for the proposed additional power plants Nos. 3 and 4 on Big Creek. The water from Shaver Lake will eventually be used through three power plants, with a total drop of 4000 ft. (1220 m.). In acquiring this property the Edison company became owner of a large and important tract of timber in addition to the valuable reservoir site. At a later date this timber will be cut and carried to the market over the company's own railroad line, which is already in operation.

It is proposed to develop the Shaver Lake reservoir to an initial capacity of 50,000 acre-feet (60,000 cu.m.) and an ultimate capacity of 146,000 acre-feet (175,000 cu.m.). The average run-off with 50,000 acre-feet storage will produce approximately 125,000,000 kw.-hr. annually in the Big Creek plants Nos. 2 and 3 and the Forebay plant No. 5, which as used would be equivalent to an increased capacity of 30,000 hp.

The preliminary work on this development has already started, and it is expected that the 50,000-acre-foot reservoir with the necessary connecting tunnels will be completed in 1920 and ready for the winter rains of 1920-1921. The altitude of Shaver Lake is 5200 ft. (1585 m.), while the altitude of Huntington Lake is 7000 ft. (2130 m.), the distance between the two lakes being approximately 12 miles (19 km.).

CHICAGO AND ONTARIO OPERATIONS COMPARED

President Insull of Commonwealth Edison Company Meets a Discussion on Public Ownership by Statement of Facts and Comparison of Figures

Samuel Insull, president Commonwealth Edison Company of Chicago, recently compared some of the facts of operation of that system and the Hydro-Electric Power Commission of Ontario. Mr. Insull's discussion was contained in a letter which was printed in the Chicago *Herald and Examiner* and was an answer to an editorial in that paper. Mr. Insull said:

An editorial entitled "Public Ownership" in the *Herald and Examiner* of June 30 contains some statements which are so unfair and misleading that, speaking particularly on behalf of the Commonwealth Edison Company, I cannot allow them to go unchallenged.

It is not true to say that the opposition to municipal operation of public utilities is based merely on the repeated assertion that "public ownership wherever tried has been a failure." On the contrary this opposition is based on the facts of experience. Comparing the privately operated electric utility in Chicago and the publicly operated Hydro-Electric Power Commission of the Province of Ontario as was done in the editorial, here are some of these facts:

Chicago, unlike the Province of Ontario, has no Niagara Falls at its door. The Hydro-Electric Commission pays no taxes, nor does it render lamp service to its customers. Not only that, but, according to the Clarkson report, it charged up to the province at large $1,117,433 of power general expense which, if, included as it should be, would increase the average residence rate by two-thirds of a cent, or to 3.78 cents. Furthermore, it is reported to be asking for a rebate of duties paid upon Hydro-Electric equipment, declaring that, if this is not granted, it must, in addition to the general increase in power rates in 1918, make another increase in its rates. It is to be remembered also that the average rate of pay per employee of the Chicago company is about 14 per cent higher than that of municipal stations in Ontario.

The average Chicago residence customer pays 6.08 cents per kilowatt-hour for electricity, not 9 cents, as might be inferred from the editorial. The 9-cent rate is simply the prompt-payment maximum which the company must not exceed. Furthermore, the Commonwealth Edison Company paid $2,800,000 in taxes and municipal compensation last year, also expending about $800,000 for lamp service for customers. If these items were deducted to compare with the Ontario situation, the Chicago average residence rate would be brought down to 4.83 cents. The remaining difference between the average residence rate in Chicago and Ontario as corrected above—that is, the difference between 4.83 cents and 3.78 cents—is more than accounted for by the difference between coal and water power, the difference in rate of pay per employee and the large proportion of lines that are underground in Chicago, compared with cities supplied by the Ontario commission. It is to be noted, also, that, notwithstanding the great increase in the cost of labor, fuel and apparatus, the Commonwealth Edison Company has not asked for an increase in its rates.

Another important reason for some difference in cost is that the Chicago company protects its customers and the industries of Chicago with a reasonable reserve. During the war emergency the Ontario commission was unable to fulfill its power contracts and supply sufficient power to its

customers, to a very serious extent, because of lack of reserve, while the Chicago company at all times has supplied all the demands made upon it.

Consider what the foregoing figures mean. The Chicago company paid out at least $3,600,000 last year for taxes and lamp service for which the Ontario commission did not pay out anything. To go further, note the report that the Hydro-Electric Commission was compelled to charge up to the province at large $1,117,433 of power general expense. Here are items amounting to millions of dollars annually that the taxpayers of Ontario pay, directly or indirectly, for electric service received from the Hydro-Electric Commission and yet which is not included in the kilowatt-hour charge. But corresponding charges are included in the Chicago rate, and if they were included in the Ontario rate the latter would be much higher.

The Commonwealth Edison Company takes the low-grade coals of the prairies of Illinois and Indiana and makes electrical energy for the people of Chicago at an average rate which I believe to be lower than that offered in any other large city in the world where electricity is produced from coal.

I think that writers who discuss the important questions of public versus private operation of public utilities should be very sure of their facts.

RAIN AFFECTS SERVICE IN THE NATIONAL CAPITAL

Result of the Heavy Downfall at Washington Interruption of Supply for Almost Four Hours—First Occurence of Kind in Fourteen Years

As a result of the recent heavy rains in Washington, one of the main conduits of the Potomac Electric Power Company caved in on Monday of this week, snapping an electric cable and short-circuiting the high-tension feeder and also paralyzing the feeders of the three substations. The electric company has a reserve feeder, and service was finally restored through this artery. For almost four hours electric lights were out, elevators stopped running and the afternoon newspapers were halted in the midst of running off editions.

According to officials of the company, this is the first time since the installation of the main generating plant, nearly fourteen years ago, that there has been a general interruption in the service which lasted such a length of time.

RESIGNATION OF EMPLOYEES FROM THE PATENT OFFICE

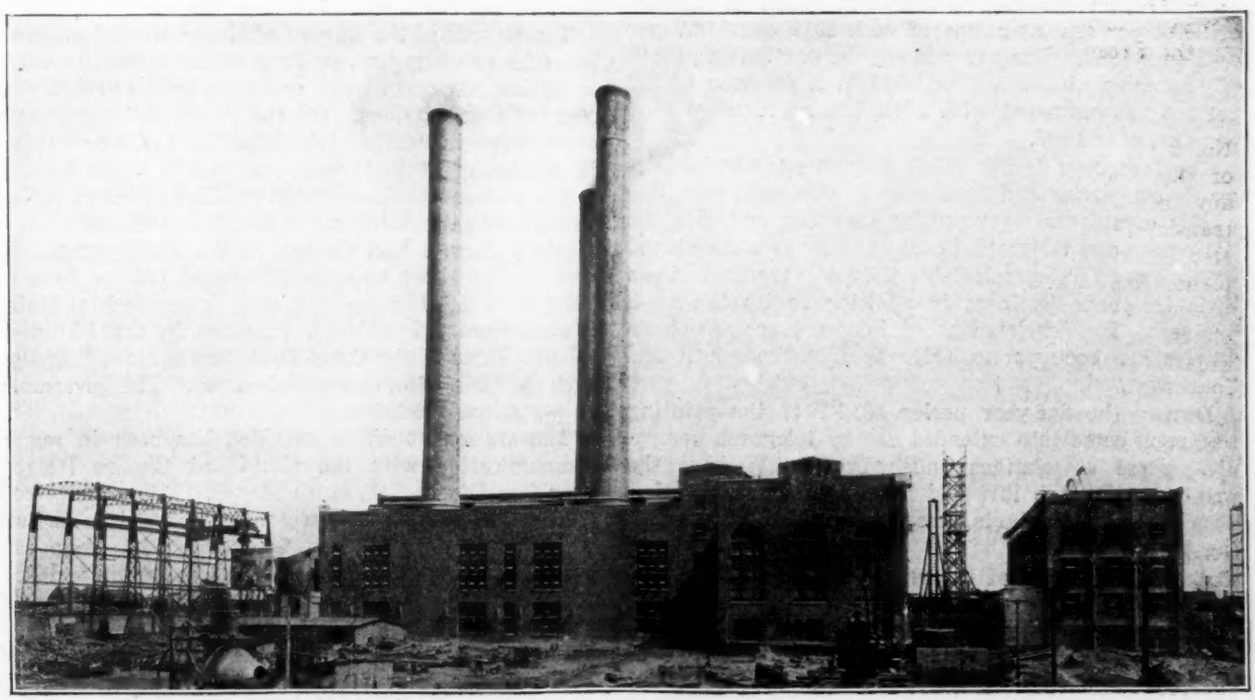
Rate of Withdrawal Increased Very Largely in Last Three Years, According to Testimony Given Before House Committee on Patents

The rate of resignation from the Patent Office has increased from 25 per cent in three years to 25 per cent per annum, according to James T. Newton, Commissioner of Patents, who testified before the House committee on patents in Washington on the bill proposing an increase in salary for employees of the Patent Office.

Mr. Newton pointed out to the committee that he was unable to get competent help, that out of a call for 100 men he was able to get only six from civil service examinations, and that he has been obliged to retain a large number of temporary employees.

Frank J. Sprague told the committee of his experiences with the Patent Office and the patent courts. He said that his attempts to obtain patents had caused him much expense and anxiety, the result being that he was frequently obliged to appear before the patent courts.

New Generating Station of the Acme Power Company of Toledo, Ohio



This station at present contains one 20,000-kw. turbo-generator with room for three other units of the same size. It can be expanded for an ultimate total rating of 200,000 kw. The switch house and general office building is shown at the right and the coal-handling structure at the left.

CENSUS RETURNS ON THE TELEGRAPH SYSTEMS

Small Increase in Mileage of Wire but Large Increase in Traffic—Private Wireless Systems and Government Plants

According to a report just issued by Director S. L. Rogers of the Bureau of the Census, Department of Commerce, the twenty-one commercial land telegraph systems in the United States in 1917 operated 241,012 miles of pole line, comprising 1,888,793 miles of wire, sent 151,725,238 messages and employed 47,227 persons, to whom were paid salaries and wages amounting to $36,392,140. This report, "Telegraphs and Municipal Electric Fire-Alarm and Police-Patrol Signaling Systems," was prepared under the supervision of Eugene F. Hartley, chief statistician for manufactures.

The pole-line mileage in 1917 was less by 2.6 per cent than in 1912, but was greater by six-tenths of 1 per cent than in 1907. The wire mileage, however, showed an increase of 4.1 per cent as compared with 1912 and of 19.7 per cent over 1907. The increase in the number of messages was much greater—45.7 per cent during the last five-year period and 53.1 per cent during the ten years from 1907 to 1917. The number of employees increased by 39.2 per cent between 1912 and 1917 and by 84.9 per cent during the period 1907-17, and the corresponding percentages of increase in salaries and wages were 59.2 and 124.2.

The number of telegraph offices in 1917 was 28,865, a decrease of 6.2 per cent as compared with 1912 and of seven-tenths of 1 per cent as compared with 1907. Total income from telegraph traffic was $91,312,567, an increase of 74.5 per cent over 1912 and 140.8 per cent as compared with 1907; income from all other sources was $1,641,803; total expenses, including charges for depreciation and sinking funds, were $80,828,970, an increase of 52.9 per cent over 1912 and 111.4 per cent over 1907; and net income was $12,125,400, an increase of 253.4 per cent as compared with 1912 and 113.7 per cent over 1907. The par value of the outstanding stock of the companies was $106,360,237, a decrease of 1.7 per cent as compared with 1912, but an increase of 4 per cent over 1907.

The foregoing figures relate only to commercial telegraph companies and thus exclude wire and pole line wholly owned and operated by railroads and also the equipment and telegraph business of press associations.

The Postal Telegraph-Cable Company transacts some little telephone business in addition to its telegraph business. Its development of long-distance telephone service has been particularly rapid in the South and Southwest.

During the five-year perior 1912-1917 the printing telegraph came into extended use by telegraph companies, press associations and railroads. Without the printing telegraph it would have been difficult or impossible to handle the increased telegraph business during the war.

A special feature of the report relates to train dispatching. The use of the telephone for this purpose has increased rapidly. The report shows for 1917 105 lines employing this method as against forty-two in 1912. The mileage of telephone pole line for train-dispatching purposes was 95,268, an increase of 67.6 per cent as compared with 1912, and the mileage of wire was 201,662, an increase of 55.7 per cent over 1912. The total line mileage of railroads reporting the use of telephones for transmitting train orders in 1917 amounted to 110,404. It is asserted that not a single accident has resulted from the use of telephones in train dispatching.

WIRELESS TELEGRAPH SYSTEMS

All wireless telegraph systems in the United States were taken over by the federal government under authority of an executive order issued April 6, 1917, for which reason the figures for 1917 gave little indication of the increase in commercial wireless telegraph operations during recent years. The systems reported for 1917 numbered three, as compared with four in 1912 and five in 1907, and the number of tower stations was sixty-three, as compared with seventy-four in 1912 and 117 in 1907. The number of messages handled prior to April 6 was 122,244. No exact record of the number transmitted during the period of government operation is available, but it is roughly estimated that 330,000 messages were handled between April 6 and Dec. 31, 1917. This number, added to that already given, would make a total of more than 450,000, representing an increase of approximately 58 per cent as compared with 1912 and 191 per cent over 1907.

Total income and net income increased greatly. The former aggregated $1,385,060 in 1917, representing a gain of 107 per cent over 1912 and 1197 per cent over 1907; the latter amounted to $609,526, as compared with a net income of $4,738 in 1912 and a deficit of $53,538 in 1907. Employees numbered 586, a decrease of 38.8 per cent from the corresponding number in 1912, but an increase of 233 per cent over 1907, and salaries and wages aggregated $461,402, an increase of 17.2 per cent over 1912 and 464.3 per cent over 1907.

In addition to the commercial shore stations, there were in operation during the early part of the year 6089 general and restricted amateur stations, eighty-eight special amateur stations, seventy-five experimental stations and forty-seven training schools.

The records of the Bureau of Navigation of the Navy Department show that on June 30, 1918, there were in operation 134 commercial shore stations and 838 commercial ship stations. Of the shore stations ninety-seven were in continental United States, twenty-eight in Alaska, eight in Hawaii and one in Porto Rico.

The government has erected wireless plants at various points along the Atlantic and Pacific coasts and at Pearl Harbor, Hawaii and Cavite, in the Philippines. The government shore stations numbered 135 on June 30, 1918, of which eighty-eight were in continental United States, twenty in Alaska, nineteen in the Philippine Islands, three in the Canal Zone, two in Hawaii and one each in Porto Rico, Guam and Samoa. The government ship stations totaled 470.

The station at Arlington, Va., has been in regular communication with the station at Chollas Heights, near San Diego, Cal., since May 1, 1917. Direct communication with an Italian government station in Rome was also established. On Sept. 29, 1917, radio communication was established between Arlington and Pearl Harbor, Hawaii, via Sayville, N. Y. Messages are now transmitted between Arlington and the Philippines through San Diego, Cal., and Pearl Harbor, Hawaii. Under favorable conditions at night the Arlington station can communicate directly with the Pearl Harbor station, but the usual practice is to relay through San Diego.

FINANCING OF EXPORT TRADE UP IN CONGRESS

Bill Introduced by Senator Edge of New Jersey Is Approved by Secretary of the Treasury Glass and Federal Reserve Board

A bill has been introduced into the United States Senate by Senator Edge of New Jersey designed to promote the financing of the country's foreign trade by permitting the formation of one or more huge American companies which would furnish capital for exporting American goods on a large scale. Under the legislation a gigantic corporation might be formed, with a capital of hundreds of millions of dollars, to extend credits and supplies to the devastated countries.

Senator Edge's bill would accomplish its object by an amendment to the Federal Reserve act providing for incorporation of export companies under federal charter. They would be under the supervision of the Federal Reserve Board and would be allowed to establish foreign branches and purchase stock of similar corporations. The proposed measure has the support of Secretary of the Treasury Glass and the Federal Reserve Board.

Senator Edge said, in part, in discussing the proposed legislation:

This measure provides for the federal incorporation of one or more concerns to handle the composite commercial-financial business of the American export trade. Not only may such corporations exercise the ordinary banking functions, such as discounting and negotiating notes and drafts, dealing in bills of exchange, and so on, but they actually may advance cash to foreign purchasers of American exports, on such security, say, as a foreign manufacturing plant or similar collateral.

This bill provides adequate though minimum government supervision, without government participation or underwriting or guaranteeing.

Financing of foreign purchases is absolutely necessary to keep American industries going and their hands employed. Also, by lubricating American industries, it will provide cargoes for the American merchant marine and, finally, it will automatically preclude the imposition of foreign embargoes on American goods, as no country wishing to do business with us on such generous terms as we propose would dare generally to impose embargoes, or at least we, as the bankers, must be expected to exact our own terms.

WAR-TIME FINANCING FOUND HIGH IN COST

Promise of Improvement Seen by Henry L. Doherty—Output of One Company Increased More than Ten Times in Five Years

A summary of the genera. condition of the public utility subsidiaries of the Cities Service Company was given by Henry L. Doherty, the president, in the annual report issued to shareholders. Among the interesting achievements mentioned by Mr. Doherty is the fact that the demand and output of the Trumbull Public Service Company, Warren, Ohio, have increased more than ten times in five years.

The public utility susidiaries of the company, in common with all other public utility companies, had difficult conditions to meet during the year on account of greatly increased operating cost. Labor, fuel and all materials required by these companies continued at high prices. This condition, which had arisen in the previous year, led to an active campaign for relief through increased rates.

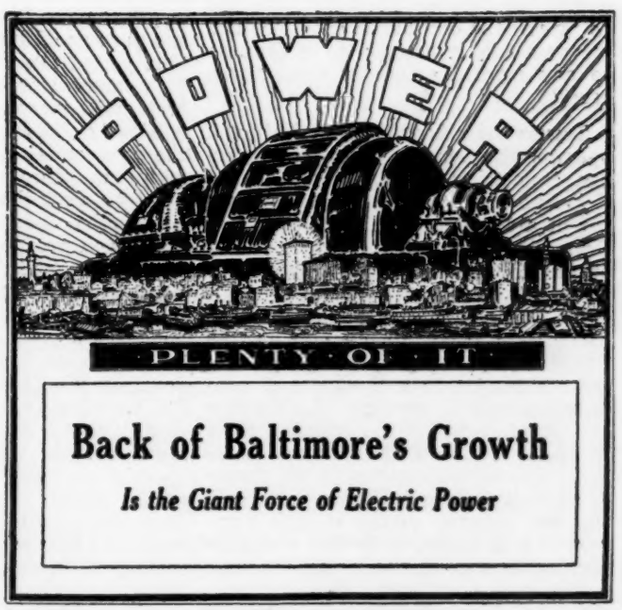
As the year progressed, the seriousness of the situation became increasingly evident to public service commissions and other regulatory authorities, and Mr. Doherty says that these bodies accordingly gave more favorable consideration to the problem. In the majority of cases requests for relief received fair treatment at the hands of both the state and the municipal authorities.

Immediately following the signing of the armistice new conditions ensued which materially helped the situation. During the war period it had been almost impossible to secure sufficient forces to operate and maintain the properties at a high state of efficiency. While labor costs have not decreased, a more plentiful supply has made it possible to secure better results.

On account of the war relatively little new construction work was inaugurated. The first unit of the Acme Power Plant at Toledo, Ohio, was completed, and the plant additions of the Trumbull Public Service Company at Warren, Ohio, were also completed.

The gross earnings of the public utility subsidiaries of the company were substantially greater in 1918 than in the preceding year, and in spite of continued increases in operating costs, the net earnings from operation were also improved. "The increase in these net earnings, however," adds Mr. Doherty, "was more than offset by the increase in interest and amortization charges occasioned by the high cost of money in war times to provide funds for the refunding of maturing obligations and to finance the growth of these companies. As a result, the earnings accruing to the Cities Service Company from its public utility subsidiaries were diminished compared with last year, but the steps taken toward increasing the rates for service and the present improved financial situation give promise that this condition will be corrected in the forthcoming year."

"Never-Failing Economical Electric Power"



The Consolidated Gas, Electric Light & Power Company of Baltimore advertises its power service to industrial users. "New and expanding industries," it says, "will depend upon central-station service in the future even more than in the past."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Valuation at War-Time Prices.—In dismissing a joint petition of the Southern Illinois Light & Power Company and the Centralia Gas & Electric Company for authority to purchase and sell electric and gas property of the Centralia company, the Illinois Public Utilities Commission discusses valuation made upon war-time prices. It says in part: "The commission cannot subscribe to a valuation which is based upon war-time prices in a case where substantially no investment has been made under war-time conditions. To do so would result in burdening a public already carrying a heavy load of war-time prices with increased costs of service received from plant and equipment which has experienced no added usefulness because of the war-time situation. Such a burden so placed could benefit only the interests selling the property, to the permanent disadvantage of the public which receives the service and the utility which would assume the responsibility of operating it upon a financially sound basis. We do not wish to be understood as condemning investment wisely and prudently made in the necessary development of utility property during war times. In many cases extensions and betterments have been made in the interest of the public good under these unusual and trying conditions. Capital so invested is entitled to consideration, but such does not appear to be the case to any marked extent in the present case."

Transmission Line Crossing Railroad.—An application for a restraining order prohibiting the Bessemer & Lake Erie Railroad from removing the crossing of a transmission line of the West Penn Power Company over the tracks of the railroad company in West Deer Township was refused by the Pennsylvania Public Service Commission. The commission says: "In our opinion, the public service company law empowers the commission to authorize such construction and to regulate the manner and place in which the crossing shall be made. Such authorization and regulation are not an exercise of the power of eminent domain, which we have held was not granted to the electric company by the public service company law, but is a utilization of the supreme police power of the commonwealth which has been placed in the hands of the commission by the Legislature. The crossing, if made, will not be for the benefit of the electric company but for the benefit of the public to be served, and the use to which the property of the railroad may be subjected will be a public use of a public highway. We are convinced that the distinction which has always existed between the exercise of the right of eminent domain and the exercise of the police power is apparent in this case and that the Legislature has lawfully authorized the commission to subject the property of the railroad company to another public use such as is here contemplated. We do not at this time pass upon the necessity or propriety of the construction of the crossing at this place or in the manner proposed. The electric company has not made an application to this commission for the approval of the construction which complies with our rules and regulations. We suggest that the crossing which has been constructed under the contract be allowed to remain, so that the consumers of the electric company will not be inconvenienced because of its failure to present a satisfactory application for the approval of the construction. As soon as such application is made to us we will pass upon the question of the necessity or propriety of the proposed construction—a question which the parties agreed should not be disposed of until after we had passed upon the matters which we have above discussed."

Construction in Anticipation of Actual Requirements.—The West Virginia Public Service Commission in deciding to allow in part rate increases sought by the Appalachian Power Company discussed the policy of constructing large plant facilities to meet the developing needs of the communities served. It stated: "From the statement of our statistician, together with other evidence, it seems clear that at least for the first four or five years of its operation the applicant had an investment and a capacity greatly in excess of the requirements of its consumers and that the power sold by the applicant during that period could have been developed by a much smaller plant and at less cost and expense. We say this in no spirit of criticism, since it appears that the promoters and managers of the applicant company were building a plant to meet the requirements of the prospective industrial development of the region proposed to be served by it. The wisdom of this course seems to be demonstrated from the fact that it is stated by the general manager of the applicant company that since August, 1917, both its hydroelectric and steam auxiliary plants have been working at full capacity to supply its consumers' demands, and that other customers demand service which cannot be adequately supplied until the completion of the steam plant at Glen Lyn. It therefore seems obvious that the promoters of this enterprise could not reasonably have expected to earn during the early development period of its operation a return commensurate with the initial investment. The applicant is now performing a very useful and valuable public service, and public policy demands that the development of such enterprises should be promoted and encouraged by governmental regulating agencies to the extent at least of assuring those who have invested their money, energy and business experience therein, and have incurred the hazards and risks incident to the business, such fair return upon the value of the property used in such public service as will not only be an adequate compensation after it becomes a developed and going concern but will likewise provide for the early losses necessarily sustained."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Illinois State Electric Association.—The annual convention of the Illinois State Electrical Association will be held in Chicago Oct. 22 and 23. These dates coincide with the date of the Chicago electrical show.

A.I.E.E., Panama Section.—The September meeting of the Panama Section of the American Institute of Electrical Engineers will consist of a trip to the United States naval air station and submarine base at Coco Solo, Canal Zone, and an inspection of the new electrical installation there. A. C. Garlington will speak.

American Institute of Mining and Metallurgical Engineers.—This institute will hold its annual meeting at Chicago from Sept. 22 to 26 inclusive. The committee in charge of the convention has received more than 150 papers to be read at the technical sessions. The tentative program includes a tour of inspection through the La Salle industrial district.

A. I. E. E., Philadelphia Section.—The officers of this section of the American Institute of Electrical Engineers for the year 1919-20 are: C. E. Clewell, chairman; Nathan Hayward and W. S. James, past-chairmen; Harold Pender, L. J. Costa, P. H. Chase, N. E. Funk, Baxter Reynolds and E. B. Tuttle, managers; R. B. Mateer, secretary-treasurer; Raymond Bailey, assistant secretary.

Empire State Gas and Electric Association.—The electric and distribution sections of this association held a meeting at Syracuse recently during which several interesting papers were presented. The general theory and causes of electrical disturbances and the methods employed in controlling them or protecting machinery against them were discussed by E. G. Newton of the General Electric Company in a paper entitled "Lightning Protection of Distribution Circuits." "Transformer and Meter Loading" and "Power-Factor Measurement and Protection" were also discussed at this meeting.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Free Fan Service.—Following the practice of the past several years, all electric utility companies managed by H. M. Byllesby & Company have renewed the practice of furnishing free electric fan service during the hot weather to invalids unable to pay for it.

Board Appointed to License Oregon Engineers.—A state board of engineering examiners has been appointed by Governor Olcott of Oregon in conformity with the act passed by the last Legislature requiring the licensing of all professional engineers. Under the new law all engineers will be required to register. The board consists of two civil engineers, two mechanical engineers, two hydraulic engineers and one electrical engineer.

Illinois Legislation.—The Legislature of Illinois adjourned June 30 without having passed any drastic legislation affecting the public utilities law. The Legislature passed a bill creating a state tax commission of three members and abolishing the state board of equalization. The new commission exercises all duties imposed by law in reference to the assessment of property for taxation. Governor Lowden has appointed the following members of the state tax commission: Frank F. Noleman, chairman, Centralia, attorney and banker; Joseph B. Sanborn, Chicago, colonel in command of the 131st Infantry during the war with Germany; Judge Charles C. Craig of Galesburg.

Chicago Street-Lighting Contracts.—The Sanitary District of Chicago and the city of Chicago have entered into a new contract for street lighting under the terms of which the city agrees to pay the district for all electrical energy furnished between Dec. 8, 1917, and Dec. 31, 1917, at the rates specified in an original agreement, and to pay the district for the maintenance and operation of the substations of the city during that period the actual cost of all labor and material, plus 15 per cent, and to maintain and operate all city substations after Jan. 1, 1918, at its sole cost and expense. The district agrees to furnish the city electrical energy for its street-lighting purposes to the amount of 10,000 kw., designated as the "firm power," and if the city requires a greater amount of electrical energy for its street lighting to increase this by 2000 kw., in which case the city is to relieve the district of part of its pumping load. Electrical energy is to be billed at $1.25 per kilowatt per month, based on thirty-minute maximum demand.

Percentage of Generated Output Accounted For.—In the annual report issued by the Dayton (Ohio) Power & Light Company for stockholders it is stated that 88.48 per cent of the total generated output was accounted for in 1918, as compared with 87.28 per cent in 1917.

Felony to Destroy Electrical Apparatus.—A bill has been passed by the State Legislature of Missouri making it a felony to destroy electrical machinery. This bill, it is thought, will be of considerable value in helping to maintain service of utilities if disorderly strikes should take place.

Labor Federation Indorses Scientific Research.—The American Federation of Labor went on record at its Atlantic City convention as favoring a broad policy of scientific research by the government. The following resolution was passed: "Resolved by the American Federation of Labor in convention assembled, that a broad program of scientific and technical research is of major importance to the national welfare and should be fostered in every way by the federal government, and that the activities of the government itself in such research should be adequately and generously supported in order that the work may be greatly strengthened and extended; and the secretary of the federation is instructed to transmit copies of this resolution to the President of the United States, to the President pro tempore of the Senate, and to the Speaker of the House of Representatives."

Rehabilitation and Re-education of Injured Employees.—Charles E. Morrison, chairman, J. C. Robinson and Ralph Elsman, as a committee, have reported to the Empire State Gas and Electric Association on the "Rehabilitation and Re-education of Injured Employees." They believe that every case must be carefully considered according to its own merits, and it might prove impracticable in many cases to educate a man in a vocational school, whereas, on the other hand, he could be successfully trained in the company's works. They unhesitatingly recommend that every employer of labor in the public utility industries in the State of New York undertake to rehabilitate and re-educate any employee who through accident may become physically incapacitated. The rehabilitation—that is, the supplying of artificial limbs, etc.—should be arranged for through the agency of some institution or other channel, such as the Red Cross Institute for Crippled and Disabled Men, Fourth Avenue and Twenty-third Street, New York City, which is efficiently equipped to do this work. The training should be undertaken either at the property itself or at some central plant or institution, wherever is most feasible. The point is, however, says the committee, that the injured employee should be intelligently rehabilitated and re-educated so that he may be able to earn as good a living as before the accident occurred.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Party Who May Claim Error.—In an action against the owner of a theater and an employee who installed an electric fan which became loose from its motor and fell, striking plaintiff on the head, the court advised the jury that the presumption of negligence from the happening of the accident did not apply to employee (181 P. 81).

Liability of Central-Station Company.—Where a furnisher of electricity supplies a customer first through its own wires owned and maintained by customer, over which the furnisher has no control or supervision, and an injury results by reason of negligent manner in which the customer's wires are equipped and maintained, the furnisher is not liable, according to a decision of the Appellate Court of Indiana (123 N. E. 432).

Action of Fuse and Circuit Breaker in Case of Accident.—In a suit for damages for alleged negligent killing of deceased, who came in contact with a live broken wire, whether the installation of a fuse on the switchboard would have the same effect as a circuit breaker is for the jury to determine, according to the Court of Civil Appeals of Texas. It has also been held that the jury having found upon independent issues that defendant was negligent in failing to make proper inspection of its wires and remedying danger resulting in death of plaintiff's intestate, a refusal to instruct with reference to whether installation of a fuse on the switchboard would have same effect as circuit breaker was not a reversible error (211 S. W. 600).

Experimental Rate Orders.—The Supreme Court of Appeals of West Virginia has held (99 S. E. 63) that one seeking to suspend an experimental or provisional order of the Public Service Commission, fixing a rate for the purpose of furnishing temporary relief to a public service corporation, as well as for the purpose of securing the evidence necessary to a permanent adjustment of its rates, must show from the evidence heard by the commission that the enforcement of such order will result in an unreasonable and arbitrary burden upon him. Incidental inequalities which may arise from the administration of such public service company's business under such an order will not be sufficient ground for suspending the same where it appears that there is reasonable necessity for the evidence which will be gained by such administration in order to properly determine and readjust such rates.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

J. H. McNeely has been appointed local manager of the Shore Line Electric Light Company, Norwich, Conn., to take the place of E. O. F. McLean, who has recently resigned.

Bert H. Peck, who was electrical engineer for the Public Utilities Commission of Illinois, has resigned to accept the position of general manager of the Southern Illinois Light & Power Company, St. Louis, Mo.

C. H. Howell, who was recently elected president of the Ohio Electric Light Association, entered the public utility field immediately after being graduated from the Richmond (Va.) College in 1905. With the exception of a few years as apprentice and commercial engineer for the General Electric Company, he has been in that line of work ever since. Coincident with his work

C. H. HOWELL

in the General Electric Company student course, Mr. Howell took a postgraduate course in thermodynamics and electrical engineering at the Massachusetts Institute of Technology. In 1912 he became manager of the Coshocton (Ohio) Light & Heating Company. Later other properties in the same section of Ohio were also placed under Mr. Howell's jurisdiction. When the number had grown to eight the companies were merged into a single corporation, which is now known as the Ohio Service Company, of which Mr. Howell is manager.

George Ellery Hale, director of the Mount Wilson Observatory and foreign secretary of the National Academy of Sciences, who has been for the last ten years a correspondent of the Académie des Sciences, Institut de France, has received the unusual honor of election as "associé étranger," taking the place of Adolph von Baeyer, declared vacant by the Academy. The foreign associates are limited to twelve. This high distinction has been held by only two Americans—Simon Newcomb and Alexander Agassiz. The National Research Council, upon the presentation and acceptance of Dr. Hale's resignation as its chairman and the election of James R. Angell as his successor, created and bestowed in perpetuity upon Dr. Hale the title of honorary chairman in recognition of his services to the National Research Council and to science and research by indefatigable efforts that have contributed so largely to the organization of science for the assistance of the government during the war.

Arthur Groesbeck, manager of the Rocky Ford Milling & Power Company at Abilene, Kan., through the purchase of the Marshall County Power & Light Company at Blue Rapids, Kan., now becomes manager of both systems. His headquarters will be at Manhattan, Kan.

H. W. Steele, for five years superintendent of the gas and electric departments of the El Reno division of the Oklahoma Gas & Electric Company, has been appointed general manager of the gas and electric departments at Muskogee. Earl James of the Oklahoma City division of the company has succeeded Mr. Steele at El Reno.

L. W. W. Morrow, who has been at Yale on leave of absence from the University of Oklahoma during the past year, has been retained at the former university as assistant professor of electrical engineering. Professor Morrow was in charge of one of the divisions of the Signal Corps training schools for officer candidates while it was active. When at the University of Oklahoma Professor Morrow was director of the School of Engineering and took an active interest in the public utilities of the state, particularly in connection with engineering and valuation matters.

G. F. Wittig has been made assistant professor of electrical engineering in the Sheffield Scientific School of Yale University. During the past year at Yale he was first associated with the Signal Corps training school for officer candidates and after its disbanding a member of the physics department. Professor Wittig received his degree at Columbia. He was associated for a time with Westinghouse, Church, Kerr & Company and assisted A. V. Abbott in the revision of his book on electrical transmission of energy. He was for several years head of the department of electrical engineering and physics at the University of Alabama and was later assistant professor of electrical engineering at the University of Pennsylvania. During last summer he was associated with the radio division of the Bureau of Standards and was co-author of the book on radio written by the Bureau of Standards which has appeared as Pamphlet No. 40. In the summer of 1917 he was division engineer in the construction of Camp McClellan.

Donald A. Henry, formerly assistant electrical engineer of the Public Utilities Commission of Illinois, has been appointed electrical engineer to succeed Bert H. Peck, who has resigned.

Ward M. Burgess has been elected president of the Nebraska Power Company, succeeding Gen. George H. Harries, who has resigned. Mr. Burgess, heretofore vice-president of the company, is a prominent Omaha business man and well known nationally as the successor to Frank A. Vanderlip in the war savings stamp campaign. Mr. Burgess was born at St. Joseph, Mo., on June 20, 1870, and entered business in that city as a billing clerk. He went to Omaha as an employee of M. E.

WARD M. BURGESS

Smith & Company, and was rapidly promoted from bookkeeper to chief accountant, credit manager, and to general manager in 1898. On the death of Monroe E. Smith, he was elected vice-president of that company, a position which he still holds. Mr. Burgess is a director of the Omaha National Bank and vice-president of that institution. He is also associated with department-store interests in Omaha and in 1914 organized the Burgess-Nash store. In Omaha he is a member of the Omaha Club, Omaha Athletic Club, Field Club, Country Club, Rotary Club, Ak-Sar-Ben and the Chamber of Commerce.

Arthur G. Gibbony has resigned as superintendent of the Fort Madison (Ia.) Electric Company, a Stone & Webster property, after several years, to form a partnership with Arthur W. Weinhardt and conduct an automobile storage-battery service station. A general electric wiring, contracting and supply business will also be conducted under the name of the Lee County Electric & Battery Company. Mr. Weinhardt for several years was master mechanic and electrical superintendent of the Perfection Tire & Rubber Company of Fort Madison, Ia., and later spent several months at the Hog Island shipyards.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

ELECTRICAL GLASSWARE PRICES HAVE ADVANCED

Probable Demands of Labor Foretell Still Higher Prices in the Future—Commercial Lines Are Selling Well This Summer

Electrical glassware is finding a big market this summer, according to manufacturers and dealers. The needs for new commercial glassware appear to be especially large on account of the great number of changes in location and office space of business houses throughout the country. In New York City in particular these changes have been noticeable. Then, too, many stores and offices had been prevented from changing their lighting systems during the war, and this late spring and early summer saw a resumption of that business. Residential glassware, too, has found a better market than in the spring. Another cause for seeking better lighting is the policy of some office buildings which are now requiring tenants to pay for their lighting according to consumption of power. Newer types of glassware and fixtures and correct methods of illumination are supplanting former installations which could hardly be deemed to save energy or give good illumination.

Certain lines of glassware, it is stated, have this month increased in price as much as 50 per cent, while other lines have not gone up yet. Further advances are expected. The labor situation is given as the main cause of the advance. At this writing there is a convention in Atlantic City, in which there is centered much of interest to the glass trade. On it will depend whether or not labor will demand a substantial increase in September. The uncertainty of the price situation is shown where on some lines of glassware prices have been withdrawn.

Not all the glass factories are going full force. Neglected repairs of past seasons require longer shutdowns this summer for repairs. There is sufficient business, however, to utilize all the manufacturing capacity for electrical glassware. Some representatives are stocking standard material so they can make quick deliveries.

VOLUME OF SALES OF MOTORS IS VERY LARGE

Surprisingly Good Demand in Last Three Months from Widely Distributed Sources, Especially in the Smaller Sizes

Experienced motor salesmen are surprised at the strength of the market for motors up to and including 50 hp. In the spring business was rather dull, although at no time did the better houses find their trade shrinking to levels feared at the time of the signing of the armistice. Stocks were left in a decidedly ragged condition at the close of hostilities, and large motors, say of 100 hp. rating and over, were at times very difficult to obtain with promptness. As the munitions plants gradually closed their war work and cut down their production, a good deal of idle motor capacity came into the market, but not in disturbing volume. Just as much ingenuity was shown in transforming plants to a peace basis of production as appeared in their conversion to war service, and in many cases the motor installations were held virtually intact as an insurance of ample power when the change-over should be completed. Better power engineering also came to the front, and the increasing attention of central stations to the importance of taking account of power factor in rate making forced the industrial plant owner and engineer in many cases to make a careful analysis of his operating conditions with a view toward their betterment. This resulted in a large amount of motor relocation and rearrangement, which is still in progress.

The demand is now largely for motors of moderate and smaller sizes, and the intensive production maintained during normal hours by representative manufacturers has put motor stocks in a better condition than for a long time. A study of the business now being booked shows a remarkable diversity in sources and sizes of orders. An amazing amount of small-order business is being handled, and recent orders indicate that the business to be supplied during the remainder of the year may equal or exceed that of the entire year of 1918, at least in the cases of some of the more energetic distributers.

Motor prices have held fairly steady of late, barring some revisions induced by closer cost accounting, and it is to be hoped that no further material advances will become necessary. In a rough sort of way it may be said that an advance of 1 cent in the price of copper does not to-day affect the cost of manufacturing a motor more than 1 per cent, whereas before the war an advance of 0.5 cent in copper produced this result.

The demand for motors is so large that it does not seem likely that the release of second-hand equipment by government plants will produce more than temporary disturbances, if any, in prices. If labor will do its part in production, the prosperity of the motor manufacturer would seem to be assured, and with this the maintenance of first-class wages, steady work and prices which can be reasonably counted upon to go no higher and perhaps in time to subside from present levels.

THE BRAZILIAN MARKET FOR INCANDESCENT LAMPS

American Lamps Have Held This Field Since the War, but, Says British Report, Have Not Proved as Serviceable as German Lamps

Before the war in 1914 the whole of the lamp trade of Brazil was in the hands of the German "Osram" company, the lamps of which up to 50 cp. were sold by the retailers at about 29 cents to 30 cents. The Dutch "Phillips" lamp also had a certain sale, but not to be compared with that of the German product. Since the beginning of the war American lamps have largely held this field, but, according to a report by John M. Glen to the British Electrical and Allied Manufacturers' Association, the American lamps have not proved so serviceable as the German lamps.

It is impossible to state the number of lamps imported per year into Brazil, but the author of the report was of the opinion that, considering the population, it is enormous, as may be judged from the number of hydroelectric plants throughout the country for lighting even the smallest towns and cities.

The normal voltages are stated to be 110, 120 and 220, with the preponderance in the 120-volt size. The Brazilian market is at present accustomed to having the lamps marked with the nominal candlepower—that is, 5, 10, 15, 25, 32 and 50 cp.—though watt rating, it was stated, would not be a serious handicap to sales. The 50-cp. size is reported to be

most generally used. The sale of gas-filled lamps is assuming respectable proportions, and the demand, Mr. Glen said, is likely to increase, owing principally to the effect of their higher intrinsic brilliancy and also to their real economy, in which the public shows interest.

Considerable attention, it was stated, should be given to the packing of lamps. Duties are paid on the legal weight, which includes the immediate wrapping of the lamp, that is, the tissue and the cardboard, but not the wood case. Freight duties account for a very high percentage of the cost delivered in Brazil. The minimum space volume of the case, as well as the weight, is also naturally of considerable importance.

The standard socket for Brazil is the Edison screw, which is sold by the Americans and the Dutch. The German makers have their own standard screw, which, however, was so designed that it would also fit the Edison type. Electrical fittings are also of this type. The British bayonet socket, Mr. Glen stated, is practically unknown and has no market with Brazilian buyers.

INSULATING MATERIALS REACH HIGHER LEVELS

Increasing Price of Raw Materials Causes Yarns, Tapes, Cloths and Compounds to Advance in Price

How closely insulating materials follow the market conditions for the raw products is apparent from a study of what has happened during the past two weeks. As a natural conclusion to the almost daily advances in the cotton market have come frequent increases in the price of cotton products. Silk, too, has gone up. Varnished-silk insulation has increased in price about 63 per cent since April. The last increase was two weeks ago.

Varnished-cotton insulation is 20 per cent higher, 5 per cent of which occurred about two weeks ago. Cotton tapes and webbings advanced 5 per cent last week. No advance has been reported on friction tape, but it is expected to come through any day.

There has been better buying of insulating compounds and materials in the past two weeks. Sales have been getting bigger in size and are covering more varied material. Inquirers, too, have been seeking more definite information. They are asking for quotations on definite amounts rather than just for prices in general. These inquiries, moreover, have been on larger amounts. Prices are liable to change from day to day.

Linseed oil and varnishes have increased considerably. Linseed oil rose 30 cents a gallon in two weeks in the first part of July, with a resultant effect on insulating material prices.

FRENCH IMPORT MARKET FOR ELECTRICAL GOODS

Dealers Handling German Lines Prior to the War Are Now Seeking Connections from Manufacturers in Other Countries

Prior to the beginning of the war in 1914 a considerable amount of electrical goods was imported from Germany by French dealers in competition with other dealers handling French-made goods. In fact, Germany probably exported into France as much electrical material as all the rest of the world. It is thought that most of the inquiries in this line now come from the class of dealers who have lost their German connections, according to Trade Commissioner Charles P. Wood, and who naturally have no claim on French manufacturers already represented.

American underwriters' standards, he states, are not necessary in France. The French houses are more nearly fireproof than American houses and the same precautions do not have to be taken. American dealers exporting to France will have to furnish French patterns in several fittings that differ essentially from American practice. Among the more common instances will be bayonet sockets instead of screw sockets, tumbler switches instead of snap switches, and sheet-metal tube with crimped joint and lined with treated paper instead of heavy metal conduit. This light conduit employs sleeve unions instead of screwed joints.

There have been inquiries regarding the conduit mentioned above, which is scarce in France at present. Other inquiries refer to multipolar snap switches, flush-type push-button switches, all fittings requiring hard rubber in their manufacture and high-candlepower, low-voltage incandescent lamps for motion-picture machines.

While there is a certain demand for the importation of electrical goods in France at present, and while it is undoubtedly worth while to solicit this business and to take orders, if possible, it is pointed out that it is also well to bear in mind that there are French factories well equipped for making a full line of electrical goods and that their production will be on the increase. Therefore orders taken during the present emergency should not be considered an indication of a considerable future demand except in the case of specialties controlled in America.

A brief review of the relative position of American, British and German electrical manufacturers in the French market shows that in 1912 Germany exported to France $560,000 of electrical machinery, $702,000 of incandescent lamps and $1,020,000 of miscellaneous electrical supplies, a total of $2,282,000. During the year ended June 30, 1913, French imports from Great Britain were $706,000 in motors and generators, $11,000 in lamps and $300,000 in miscellaneous, a total of $1,017,000. During the same period American electrical goods were exported to France as follows: $102,189 in motors and generators, $5 in lamps and $279,781 miscellaneous, a total of $381,975.

Since that time, of course, the imports of American electrical products to Frence have increased. In the year ended July 30, 1918, for instance, they amounted to $3,774,777.

In this case, however, it must be remembered that prices had increased considerably and, besides, the purchases were largely of a war nature. On the other hand, while this business may decrease there should be an increased demand for construction of new plants and the rehabilitation of others.

The sale of surplus materials in France by the American force may, of course, affect this market to some extent.

INCREASING SALES OF WIRELESS MATERIAL

More Interest Shown as Time for Lifting of Transmitting Ban Draws Near—Some Price Reductions

Sales of wireless material and apparatus continue to advance from week to week, while particular interest has lately been shown in transmitting apparatus. Latest advices from the navy authorities convey no information as to the time of lifting the ban on transmission of radio messages by amateurs. It is expected, however, that the ban will be lifted when the President issues his proclamation of peace. It is the anticipated near approach of that day that probably has caused the increased buying of wireless material.

The younger class of amateurs has been in the market recently. Where heretofore the boy has been accustomed to spend only a couple of dollars for material he is now spending around ten times that much. He is purchasing more pieces of apparatus rather than the materials from which to make it, and when necessary to have larger parts he seems to have the money to buy them. The higher-class amateur of more mature years is also buying in better volume, and price appears to have less consideration than does quality.

Prices dropped on certain kinds of materials about the middle of July. Antenna wire of copper, bronze, other alloys and aluminum has decreased about 25 per cent. Condensers and transformers of certain makes have undergone

increases in discount, so that although single pieces hold the same price as heretofore, on quantities the price will decrease up to about 11 per cent.

The market is not local in character but is universal. Good reports come from the West and South, while the export trade is also active. The lifting of restrictions is expected to begin a bigger buying movement of all supplies and apparatus.

METAL MARKET SITUATION

Copper Advances 1¼ Cents in Active Market—Lead and Zinc Higher

Much buying characterized the copper market last week. Some heavy sales were recorded to manufacturers of electrical materials. The price advance of 1¼ cents over the previous week, with no end yet in sight, seems to have caused some manufacturers to buy for as late delivery as producers are willing to accept. With the seller holding the upper hand the buyer of copper takes what he can get. An estimate of the month's sales, at the present rate, would add about 50,000,000 lb. to last month's sales, or a 25 per cent increase.

Electrolytic is held for 23½ cents for July delivery in New York, while for September delivery it is ¼ cent higher. London prices are £104 15s. Further drops in sterling require the English buyer to pay an extra 2½ cents per pound for American copper.

There has been better purchasing of manufactured copper and brass goods and the prices have gone upward with copper. Wire at the mill is 25.50 cents, hot-rolled sheets 32.50 cents, round copper rods 29.25 cents, and seamless copper tubing 36.50 cents. This represents a 2½-cent rise since last week.

There is little change in the labor situation in the copper camps. Already some of the labor is being paid an advance of a dollar a day, equivalent to a 4-cent rise in price of the metal. The attitude of labor and its shortage, both now and expected, lead to the belief that copper production to capacity cannot be realized within two years.

Antimony has increased ¾ cent, and more active buying has followed.

Lead is up another quarter of a cent, to 5¾ cents a pound. Labor is still giving producers difficulty in both getting out the metal and in loading it.

Zinc is in the procession upward, to 8.35 cents, with a fair domestic demand.

The scrap copper and brass have responded with a 1-cent rise, with better buying, and pig lead came on with an advance of $5 per ton. Speculation in the scraps is the feature of the market.

NEW YORK METAL MARKET PRICES

	July 16			July 23		
Copper:	£	s	d	£	s	d
London, standard spot	105	0	0	104	15	0
	Cents per Pound			Cents per Pound		
Prime Lake	22.25 to 22.75			23.50 to 24.00		
Electrolytic	22.25			23.50		
Casting	21.75			22.75 to 23.00		
Wire base	24.50			25.50		
Lead, trust price	5.50			5.75		
Antimony	8.62½			9.37½		
Nickel, ingot	40.00			40.00		
Sheet zinc, f. o. b. smelter	10.00			10.00		
Spelter, spot	8.05 to 8.15			8.35		
Tin	70.50			70.50		
Aluminum, 98 to 99 per cent	32.00 to 33.00			32.00 to 33.00		

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	17.00 to 18.00	18.00 to 19.00
Brass, heavy	10.00 to 10.50	11.00 to 11.50
Brass, light	9.00 to 9.25	9.00 to 9.50
Lead, heavy	4.75 to 4.87	5.12½ to 5.25
Zinc, old scrap	5.00 to 5.52	5.00 to 5.50

THE WEEK
IN TRADE

MORE inquiries are resulting in orders than has been the rule for some time. Construction work appears to be going ahead faster, and besides, the upward trend of prices is bringing many into line before things get out of their reach. Electrical goods are on an unmistakable upward trend. Among the lines on which advances are reported are wire, flexible armored conductor, flexible non-metallic conduit, motors and safety switches.

Wire sales are constantly getting heavier. Shortages are still reported, mainly of weatherproof. Good stocks of lamps are reported with an excellent summer demand. Street-lighting equipment is now active. Rigid conduit sales are getting heavier and stocks appear to be all right, with large shipments. Fan sales were good in New England but off elsewhere. Stocks of flexible metallic conduit are still low, while orders are heavy. Schedule material is having a better demand. Heating-pad orders for the fall have begun to come in. Socket-device demand is still very heavy. The motor market in places is swamped, particularly in the small sizes.

Labor disturbances are increasing and labor shortages exist almost everywhere.

Collections are in very good shape.

NEW YORK

Jobbers, manufacturers and contractors are finding better business in all lines, it is reported. With this condition, inquiries also are growing in interest in that they are for more definite information and appear to be more genuine.

Building contracts are a little more prominent right now, according to contractors on large work, and there is much projected work now on their boards. An encouraging indication is the report that rigid conduit is moving out of the factories in better volume than heretofore this season. Several large buildings have been projected in the New York territory this past week, and there is much buying of suburban real estate.

Reports show shortage in unskilled building labor. The marine situation in New York has not become any better, and unrest has appeared among traction employees in the East. A strike vote is being taken among iron and steel mill workers in the Pittsburgh district.

FLEXIBLE ARMORED CONDUCTOR.—Prices have increased $5 per 1000 ft., and further advances are not unexpected. Copper wire has gone up, cotton for insulation has advanced, steel is not available on long-time contracts, and labor is tightening. Factory shipments have not improved. Only certain percentages of daily output can be assigned for shipment to the different parts of the country.

FLEXIBLE NON-METALLIC CONDUIT. — Cotton has sent prices up, the latest advance having been about 14 per cent. One of the larger jobbers has stocks of this material which were laid in before these last advances in the cotton market. The demand holds light.

BUSHINGS, ETC.—A large movement of bushings, connectors and lock nuts has been reported with the activity in flexible armored conductor.

CUT-OUT BOXES.—Better buying has occurred in the last two weeks.

RIGID CONDUIT.—Shipments from factories have been reported in larger volume. With jobbers the demand seems to be spasmodic.

PORCELAIN.—Low-voltage porcelain is moving slowly from rather large stocks.

LINE HARDWARE.—Much better buying has appeared in the last week or two.

FANS.—Cool weather last week proved no incentive to fan buying. Some jobbers report fair sales with low stocks and expected deliveries from factory. Others with low stocks have no more deliveries coming in.

MOTORS.—Sales have depleted stocks of single-phase motors—fractional and industrial—up to say 10 hp. Prices early in July on certain types increased back to list or in the neighborhood of 10 to 12 points. Shipments run from one to three months, depending on size of motor.

WIRE.—Wire manufacturers have jumped rubber-covered base about 2 cents to 28 cents. One is on 29, seven on 28, one on 27, two on 26 cents, and one on cost. Bare wire is being quoted on 25½ to 26 cents and weatherproof on 26 to 27 cents base.

CHICAGO

Business continues good and is growing. The building contractors last week locked out all men and put a stop to building. The electric railway men of Chicago gave their leaders authority to call a strike if they cannot agree in conference with the companies' representatives. Ten thousand workers walked out from the packing plants last week, and a similar number left the International Harvester Company. Omaha building activities are increasing. Construction was commenced last week on a one-and-a-half-million-dollar office building and a half-million-dollar hotel, and five other industrial and commercial buildings were announced, to cost about $1,000,000. The largest building permits granted in St. Louis last week were for two automobile assembling plants and an administration building for the General Motors Company, to cost about $2,500,000.

COPPER WIRE.—There is a strong market for wire, with some jobbers anticipating manufacturers' increases. The base on weatherproof and rubber-covered varies from 26 cents to 28 cents, while bare wire is being quoted on a base of 24 cents to 27 cents. Stocks are very uncertain, one large jobber having practically nothing in weatherproof below No. 6 and not a great deal of No. 6 or over.

RIGID CONDUIT.—Inquiries for larger quantities are beginning to come in, but sales are still light.

FLEXIBLE ARMORED CONDUCTOR.—There is a heavy demand for this material for wiring old houses, and the price was increased $5 per 1000 ft. last week.

NON-METALLIC CONDUIT.—Contractors are using this in large quantities. The price increased 15 per cent to 20 per cent last week.

SCHEDULE MATERIAL.—There is a slightly greater call for schedule material, but sales are not what they should be.

FANS.—More hot weather is needed to dispose of the remainder of the fan stock to the user before the end of this season.

SOCKET DEVICES.—An increase in the price of heating devices is expected next month. Jobbers find it necesary to carry large stocks in order to meet deliveries.

SAFETY SWITCHES.—Inclosed switches for industrial plants are in steady demand. Some manufacturers increased their price 10 per cent last week.

PORCELAIN INSULATORS.—Insulators for 35,000 volts or more can be delivered about as rapidly as they can be installed. Business is good. Practically all sales are for extensions and replacements.

ELECTRIC TOOLS.—There is not much call at present.

LIGHTING FIXTURES.—The manufacturers in the city are working to capacity mostly on out-of-town orders.

REFLECTORS.—The R. L. M. type reflectors are moving at a satisfactory pace under present conditions. There has been difficulty in eliminating the prejudices of some sales forces regarding this reflector, but this trouble all seems to have been ironed out.

WIRELESS APPARATUS.—Manufacturers of apparatus for amateurs are enjoying remarkable increases in business. The ban on receiving sets was lifted about two months ago, and amateurs are already equipping their sending plants in the expectation of an early government release on amateur sending operations.

NON-FERROUS ELECTRIC FURNACES. — Electric brass furnaces of the tilting type, with hearth capacities of from 500 lb. to 1500 lb., are being purchased by quite a number of Middle Western industrial plants.

BOSTON

Jobbers and manufacturers' agents are extremely busy in most lines, but retail trade was severely hit last week by a four days' strike which completely tied up the Boston Elevated system. Deliveries are getting longer, except in heavy equipment and in lines like lamps and motors, where extra effort has been made to build up stocks. Collections are running along well. Both inquiries and orders are in excellent volume. Building operations are rapidly increasing in scope. Labor offers the chief difficulty at present. Seasonal products are moving well. Industrial plants are buying considerable electrical material, betterment work being maintained over much of New England. The second-hand motor market is a little uncertain in view of pending releases by government plants outside of New England of motors no longer needed. Wire is advancing in price.

ELECTRIC RANGES.—The market is excellent. In addition to a large sale of household ranges, a good demand for heavy-duty equipments for hotels and institutions is noted. Deliveries are increasing, and prices are inclined to stiffen. Some 1920 production programs are reported to be oversold.

FANS.—Seasonal weather has drained retail fan stocks heavily, but buying from the jobbers is on a hand-to-mouth basis. After July 4 local dealers appear disinclined to stock up much, in view of the uncertainties of the weather. The humid weather of the week-end and Monday, however, led to excellent fan movement. Prices are steady.

WASHERS AND CLEANERS.—The demand is maintained "on the high gear." Sales in 1919 in New England are likely to prove record-breaking.

MOTORS.—Sales are being handled finely, despite the scattered character of business. Orders are coming in at a very rapid rate, and the last three months have shown a remarkable revival in the demand for sizes up to 75 hp. Deliveries are good except on single-phase outfits. Prices are still firm and steady.

WIRE.—Rubber-covered wire is up again, to a 29-cent base; weatherproof runs at 27 cents, and bare wire at 26½ cents. The demand is increasing.

CONDUIT.—Fair supplies are in hand. Contractors are using a good deal of pipe as building operations extend, but no serious shortage has yet come to light. Armored flexible conduit connot be stocked in any quantity, but is absorbed about as fast as it enters New England.

FLATIRONS.—An excellent market is noted.

AUTOMOBILE STARTERS AND LIGHTING SETS.—A brisk demand is maintained, and prices are firm.

TRANSFORMERS.—Trade is fairly good in moderate sizes. A 4093-kw. order has been placed with the Wagner company by the Gillette safety razor plant in South Boston. Prices are steady, and the demand for large transformers is rather light.

LAMPS.—Business is unusually good and stocks are in fine shape. Central-station orders reflect confidence in increased fall business. One large New England station increased its 1919 order for lamps by $100,000 compared with last year. Manufacturers including glass works in their plants are not worrying over the Middle West glass situation. Portable lamps are selling well.

HEATING PADS.—Fall orders are coming into the factories. The immediate demand is chiefly confined to hospitals.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries are fairly well maintained. Deliveries are still very satisfactory. Rumors of new naval business have little foundation.

ATLANTA

Activity in all lines of the electrical field continues, with marked gains in volume of business transacted in schedule material, wire, transformers and meters. Inquiries are becoming more numerous and with a corresponding increase of orders. The present prices of copper are indicative of what is coming, and every one is expecting that prices for electrical goods will go higher. While the erection of residences is going at a rapid pace, apartment-house construction in the larger industrial centers is outstripping other types and a record is being set up

WIRE.—Advancing prices have apparently stimulated further buying as manufacturers and jobbers are reporting heavier movements this week. Southeastern stocks are becoming depleted. A shortage exists for No. 10 weatherproof. Factory shipments are only fair. Weatherproof is now being quoted on a 26½-cent base and rubber-covered on 24 cents.

LAMPS.—Manufacturers and distributers are building up substantial reserve stocks to handle the local demand. Miniature sales are steadily growing and no difficulty is met in taking care of the situation. On the whole, the volume of business transacted to date exceeds that of last year.

TRANSFORMERS.— New buyers are entering the field each week. Capacities up to 50 kva. for 2300-volt distribution are moving fast, but factory shipments are good and local stocks are holding up well. The demand for the higher-voltage power type is picking up, accompanied by better promises of delivery from manufacturing points in the Eastern States.

STREET-LIGHTING EQUIPMENT.—Business is becoming more active. Inquiries are piling up, together with an increasing number of orders. Manufacturers are increasing their staff of specialists to cover the field. Prices remain steady. Shipments are very good.

METERS.—Requirements of central stations covering new cut-ins are growing and the call continues insistent for 5-amp. capacities. Stocks are in good condition and well replenished through prompt deliveries. At the present rate the total volume of business for 1919 will eclipse that for 1918.

APPARATUS.—Manufacturers are literally swamped with orders for motors, generators and turbines, experiencing no little difficulty in securing men to cover the territory. For a time shipments were improving, but factories are being flooded with unfilled orders and delivery promises remain steady.

STAMPED-STEEL BOXES.—Jobbers are buying heavily, and there appears to be no visible stock of any quantity. Factory shipments are good, however, and it is not expected that a shortage will continue. Buyers anticipate a scarcity in stamped-steel boxes this fall, which accounts for the present activity.

CONDUIT.—The call for both black and white rigid is heavy. Local stocks are in fair condition. Deliveries from factories have been increased to four weeks.

STEEL-ARMORED CABLE.—A rush of buying has depleted local stocks. A heavy movement was noticed prior to the 8 per cent advance in prices on the sixteenth. Delivery promises are growing longer, four weeks being the best.

SEATTLE—PORTLAND

Sales volumes during the past week have shown a slight increase over the previous two or three weeks because of increasing business by dealers in house-wiring devices and domestic appliances. Jobbers' sales were about the same, with little demand either from shipyards or from industrial plants.

During the week several orders for electrical equipment of considerable moment were placed by lumbering interests. One or more rural electric companies have announced their intention of extending lines immediately. One Seattle jobber reports inquiries for large motors and generating equipment. Collections, all branches of the trade agree, are in excellent shape.

The Seattle City Council has approved the proposed extension to the municipal lighting plant to cost $1,200,000 and has approved a bond issue for that amount. Approximately $100,000 of this will be utilized in building a power plant and the remainder for machinery and electrical equipment. It is reported that the Puget Sound Traction, Light & Power Company plans a line extension from Bellingham to Lake Padden.

Still greater building activity is booked for this fall. In Seattle the total building for the first six months of this year exceeded 1917 figures for the entire year by $693,000, the total for the six months being $7,407,360. The total building for 1918 was $10,899,775. Many of the less well-paid employees are quitting shipbuilding for work in orchards and fields. The telephone strike which has been on for nearly three weeks is unsettled.

The Portland districts report practically no change in the amount of business done during the past week over that for several weeks previous. Some rather important deals, however, are under consideration. Inquiries during the last few weeks have been light. There is a very unusual demand for small motors, which is so great that local stocks are in rather depleted condition. Building construction is well sustained, particularly for residences and small business buildings. It is reported that the Albina Engine & Machine Works will build four steel steamships of 6000 deadweight tons for Scandinavian interests. Contracts for six other vessels of similar capacity will be let to Portland yards, according to reports. Portland dealers report further increases in sales of domestic appliances, washing machines, vacuum cleaners and flatirons continuing as in past weeks to move in particularly large volume.

SAN FRANCISCO

Drought conditions having threatened some of the fruit orchards on the Sierra slopes, the power company was ordered to divert more water from its ditches to avert a loss. This, however, is an unusual condition this year, although prevalent enough during last season. Prune crops will be especially profitable.

During the last week of July and the first week of August all jobbers' salesmen will be away on their annual vacations, and many of the dealers have followed suit with their staffs so as to decrease the usual confusion owing to help unfamiliar with the work. This condition will decrease soliciting of business and will pile up jobbers' stocks to a certain extent, but the plan worked so well last year that it will be annually repeated.

The movement of returned soldiers is now at its peak, and has distended electrical staffs of many firms. The telephone strike is now in its sixth week, but the end is very close. Money is plentiful, and collections are easier than they have been for several months.

TELEPHONES.—Many inquiries for intercommunicating sets have been received from architects. Prompt shipment from the factory of all types is promised, but local stocks are low and not very well assorted. Several projected farmer companies are reported. The towns of Corning and Bay Point are extending their systems.

MOTORS.—Sales of single-phase repulsion motors have almost doubled during the past year.

FARM PLANTS.—There has never been such a demand for farm plants as there is just now, the high cost of construction work having deterred many of the power companies from long extensions and crop money being very plentiful. Some of the deliveries have been hampered by factory disorganization, but agents all over the state report real interest and easy sales.

FLOODLIGHTS.—The sudden cessation of hostilities found big stocks on hand and big orders placed for floodlights for the expected increase in plants requiring them, so that sales staffs generally are displaying ingenuity in devising new methods for the use of floodlights and new outlets of sale.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

Armored Conductor, Flexible Steel

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%

Twin-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft.	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft.	5%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft.	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$100.00
Coil to 1000 ft.	82.50
	No. 12 Solid
Less than coil	List
Coil to 1000 ft.	5%

Attachment Plugs

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to List
1/5 to std. pkg.	List to 20%
Std. pkg.	23% to 36%

Batteries, Dry

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.40	.40
50 to barrel	.36	.37
Barrel lots	.329	.339

Batteries, Dry—*Continued*

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.362	.372
Barrel lots	.332	.342

Conduit, Metallic Flexible

Size, In.	Ft. per Coil	List per 100 Ft.
3/8	250	$5.00
1/2	250	7.50
3/4	100	10.00
1	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/8-in. single trip	$75.00	$63.75— 69.75
3/8-in. double strip	75.00— 82.50	72.00— 75.00
1/2-in. single strip	100.00	85.00— 93.00
1/2-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.25 to $63.75
3/8-in. double strip	78.25	71.25
1/2-in. single strip	100.00	75.00 to 85.00
1/2-in. double strip	105.00 to 109.00	93.00 to 95.00

Conduit, Non-Metallic Flexible

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
5/16	.09	1 1/2	.40
3/8	.12	1 3/4	.47
1/2	.15	2	.55
3/4	.18	2 1/2	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$30.00	$22.00	$21.00
1/4-in.—	35.00	24.00	23.00

NET PER 1000 FT.—CHICAGO

	Less than 250 ft.	250 to 2500 ft.	2500 to 10,000 ft.
7/32-in.—	$33.00–$42.00	$17.50–21.00	$16.25–19.60
1/4-in.—	36.00– 45.00	19.00–22.75	17.75–21.25

Conduit, Couplings and Elbows, Rigid Iron

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37 1/2
2 1/2	.58 1/2
3	.76 1/2

Conduit, Couplings and Elbows, Rigid Iron—*Continued*

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 12.1%	6% to 14.1%
2500 to 5000 lb.	9% to 15.1%	11% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1/2 In.	3/4 to 3 In.
Less than 2500 lb.	+3% to 6.1%	2% to 8.1%
2500 to 5000 lb.	+1% to 11.1%	4% to 13.1%

(For galvanized deduct six points from above discounts.)

Flatirons

NEW YORK

List price	$6.50 to $7.50
Discount	25%

CHICAGO

List price	$6.50 to $7.50
Discount	25% to 30%

Fuses, Inclosed

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40%

Fuse Plugs

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$6.00 to $8.75
1/5 to std. pkg.	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$8.00
1/5 to std. pkg.	7.00

Standard packages, 500. List each, $0.07

Lamps, Mazda or Tungsten

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

Lamp Cord

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$28.06–$35.01
Coil to 1000 ft	25.26– 29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$21.00–$32.00
Coil to 1000	21.00– 23.00

Lamp Guards, Wire

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$29.70 to $33.00

Outlet Boxes

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–32%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	33%–40%	24%–32%
$10.00 to $50.00 list	45%–50%	32%–43%

Pipe Fittings

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

Porcelain Cleats—Unglazed

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$15.00 to $22.40
1/5 to std. pkg	12.00 to 15.35

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$17.85–$24.15
1/5 to std. pkg	14.70– 21.00

Standard pkg., 2200. List per 1000, $20.00 to 21.00

Porcelain Knobs

NEW YORK

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid	Nail-it—N.C.
Less than 1/5 std. pkg	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg	10.50– 11.20	15.35– 18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid	Nail-it—N.C.
Less than 1/5 std. pkg	$13.60–$18.40	$27.20–$36.80
1/5 to std. pkg	11.20– 16.00	22.40– 32.00

Sockets and Receptacles

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20 to list
1/5 std. pkg	List to 10%

Switches, Knife

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-qmp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%
$10 to $25 list	+10%
$25 to $50 list	+5%
	Low Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%

Switches, Snap and Flush

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp. 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

Switches, Snap and Flush—*Continued*

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	23%

Switch Boxes, Sectional Conduit

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$10.00 to $50.00 list	45%–50%	10%–47%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	30% to 33%	24% to 25%
$2.00 to $10.00 list	30% to 33%	24% to 25%
$10.00 to $50.00 list	30% to 45%	25% to 36%

Toasters, Upright

NEW YORK

List price	$6.00 to $7.00
Discount	25%

CHICAGO

List price	$7.00
Discount	25% to 30%

Wire, Annunciator

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.49
No. 18, full spools	.48

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.50 to $0.54
No. 18, full spools	.445 to .48

Wire, Rubber-Covered, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.00	$11.50	$10.00
12	20.34	20.34	15.25
10	27.72	27.72	18.48
8	38.52	32.10	25.68
6	61.02	45.78	40.68

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$21.00	$11.50	$11.50
12	26.00	17.00	17.00
10	32.90	32.90	28.50
8	45.64	39.12	39.12
6	72.45	62.10	62.10

Wire, Weatherproof

Solid-Conductor, Triple-Braid, Size 4/0 to 3 In.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$31.00
25 to 50 lb	31.00
50 to 100 lb	30.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$30.75
25 to 50 lb	30.75
50 to 100 lb	30.75

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Connector for Several-Sized Armored Cables

An adjustable connector which will fit Nos. 10 BX, 10 BX3, 12 BXL, 12 BXL3 and 14 BXL3 flexible-steel armored cables is being manufactured

FITS SEVERAL SIZES OF ARMORED CABLE

by the Rattan Manufacturing Company, New Haven, Conn. This connector, as shown in the illustration, is adjustable by means of a screw engaging two extensions on the holding clamp. Hatheway & Knott, 120 Liberty Street, New York, are general sales agents.

Steam-Jet Ash Conveyor with Square-Turn Elbows

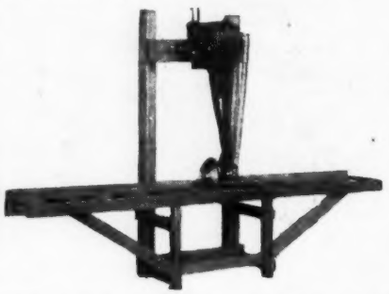
Instead of the former long-sweep steam-jet elbow, the Green Engineering Company of East Chicago, Ind., now uses one of square-turn construction in its improved steam-jet ash conveyor. This construction provides a cushioning effect from the ash impact against the back, making for longer life, the maker says. The elbow with its liners, which are small, hard iron inserts about 6 in. (15 cm.) long and weigh but 20 lb. (9 kg.), is extended 3 ft. (90 cm.) beyond the steam-jet leg of elbow, thus providing for renewing the inserts at points where extreme wear is likely to occur. A hinged-back cover permits quick access to the elbow for inspection and renewals. At this end of the elbow, as a further economical measure, a 2-ft. (0.6-m.) pipe section is connected, so that a long section worn at only one end does not have to be replaced when heavy wear takes place.

Where no steam jet is necessary, and where consequently the point of wear is at the back of the fitting, the Green ash-pack long-sweep elbow is used. The ash pack is filled with ash at the time of installation, and the ash finally drills a hole in the wearing back of this elbow. After that has occurred the ash being conveyed is projected against the ash in the ash-pack box. The barrel tank box utilizes this same ash-on-ash idea, and the hard iron baffle plate formerly used is replaced.

The intakes and their covers are provided with ground joints to prevent any air leakage at these points. All overhead pipe runs are hung from a permanent structural-steel frame. Renewals in this upper pipe line can thus be effected without tearing down the entire line.

Safety-Lock Motor-Driven Swing Saw

The motor-driven swing saw now being manufactured by the Reno-Kaetker Electric Company, Cincinnati, Ohio, is especially well adapted for use in merchandise-shipping departments or in industries where boxes and lumber must be cut to various sizes. The saw



SAW SO BALANCED THAT IT WILL SWING BACK WHEN RELEASED BY OPERATOR

consists mainly of a swing arm and base which can be mounted on any convenient wall or column.

To a bar which is movable in the base the arm and the two motor rails are fastened. As a keyway holds the rails from turning around the bar, they can still be moved from side to side. These are keyed at an angle so that when the motor is mounted its weight will outbalance that of the arm and cause it to swing back and in the rear of the table as soon as the operator releases the handle. By means of a catch device the arm is retained in the rear of the table and cannot be pulled forward without gripping the handle. This prevents the arm from swinging like a pendulum.

The arbor is in the rear of the arm of this device, which prevents injury from contact with the blade. Another feature of this design is that the belt is out of the way of the operator. The safety lock does not allow the motor to start until the saw is brought forward by the operator.

Durable Portable Cord

Instead of the usual 1/64-in. (0.39-mm.) wall of 10 per cent rubber over the two conductors, there is a $\frac{1}{32}$-in. (0.79-mm.) wall of "Beldenite" or 20 per cent rubber, in the "hard usage" portable cord ("Underwriters' P. W. P.") which has been brought out by the Belden Manufacturing Company of Twenty-third Street and Western Avenue, Chicago. Another distinguishing feature this cord possesses over the customary "weatherproof portable" is that in place of the usual soft cotton braid a heavy twine is used for the outside cover. The result is a cord said to be exceptionally strong and which will withstand exceedingly hard usage.

When this cord is used for portable lamps, tools, etc., in garages, machine shops, locomotive repair houses and similar places where cord is subjected to rough treatment, the maker declares it has a life comparing favorably with armored cable, with the additional advantage of great flexibility.

Electric Vehicle with Combined Step and Bumper

A combination bumper and step and a folding dashboard are now being supplied on the electric vehicles which the Ward Motor Vehicle Company of Mount Vernon, N. Y., is manufacturing for special use by bakeries, laundries and other businesses giving retail delivery service. As can be seen in the illustration, one-half of the dash swings

TIME TAKEN IN MAKING DELIVERIES CUT DOWN

back on the other, so that the driver can carry parcels from the car down to the ground with more ease and greater quickness than if he were compelled to step over the wheel at the side.

Vise Stand for Heavy Conduit Work

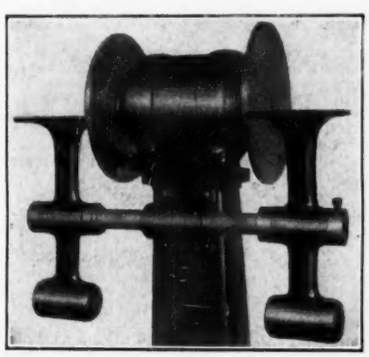
A large portable vise stand, especially adapted for heavy pipe and conduit work, has just been placed on the market by H. P. Martin & Sons, Owensboro, Ky. When equipped with a chain vise it has a capacity for 4-in. (10-cm.) pipe, and with a hinged vise it handles as large as 4½-in. (11.3-cm.) pipe. The roller in the rear pipe support enables

VISE CAN BE TAKEN DOWN AND TRANSFERRED FROM PLACE TO PLACE

one man to move a full length of pipe forward or backward and also prevents the vise from wear, as it is not necessary for workmen to slide the pipe in the vise jaws, thereby dulling the teeth. The rear pipe support, being attached to the stand, is always in line with the vise. This outfit may be readily bundled, and, with a hinged vise, weighs 170 lb. (77 kg.) complete. It is strong, rigid and durable and does not have to be fastened to the floor.

Motor-Driven Double-Disk Grinders

Allowance for convenient operation is one of the main features of the motor-driven double-disk grinder being marketed by Forbes & Myers, 172 Union Street, Worcester, Mass. The fully inclosed motor has a maximum horsepower of 2 and is equipped with Hess-Bright ball bearings, which are fully



TABLES CAN BE PLACED IN ANY POSITION

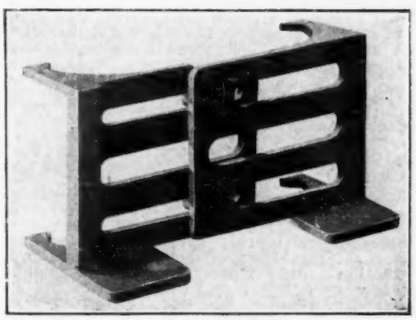
protected from dust and grit. The disks are 12 in. (30 cm.) in diameter and have a speed of 1800 r.p.m. The tables can be swung to any angle and held there by means of set screws. The grinders can be supplied for two-phase or three-phase current, 25 cycles or 60 cycles, at any voltage.

Portable Suspension Cord for Gas-Filled Lamps

Ability to withstand exceedingly high temperatures caused by gas-filled lamps is the feature of the types P and PS portable cord recently placed upon the market by the Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago. This cord, which has been approved by the National Board of Fire Underwriters, consists of the ordinary conductor, rubber-covered and then covered with a heavy braiding or serving of asbestos. The remainder of the construction—that is, the rubber outer wall and braid over all—is the same as the ordinary portable cord.

Cross-Arm Support That Obviates Pole Gain

To save time in installation and to reinforce the pole rather than weaken it are the main objects of the Heydon cross-arm support, recently placed upon the market by the Drew Electric & Manufacturing Company, Indianapolis,



FOUR "DOGS" SECURELY FASTEN BRACE TO POLE

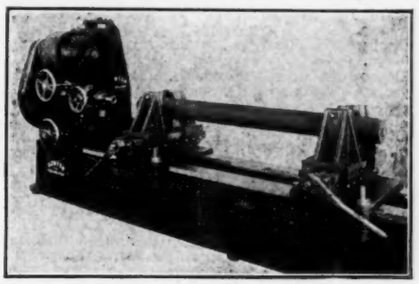
Ind. This support is adjustable to fit any pole without the necessity of cutting a gain. Four "dogs" hold the support firmly to the pole, and the sustaining platform prevents side sway or strain, holding the cross-arm squarely in position.

Light-Reflecting Paint

For use in factories, plants, offices and public buildings where high light reflection is an important factor, L. Sonneborn Sons of 262 Pearl Street, New York City, have developed "Reflectine," a paint product which is exceptionally white and has a reflection factor of eighty. Due to the fact that very little oil enters its composition, the makers declare that it will not yellow to any perceptible degree. It possesses flexibility, fume resistance, is unchanging in whiteness, and is not liable to crack or chip. The paint is made in three finishes, flat, eggshell and gloss; the flat giving the best diffusing surface, the eggshell the best combination of washable and light reflecting qualities, and the gloss very high light reflection, with the maximum sanitary attributes. It can be applied to all sorts of structural surfaces, and is supplied in a condition ready for instant use.

Motor-Driven Centering Machine

For centering rough and irregular forgings the Newton Machine Tool Works, Inc., Twenty-third and Vine



DIRECTLY CONNECTED MOTOR AND BRONZE DRIVING GEAR USED

Streets, Philadelphia, have placed a motor-driven centering machine upon the market. The machine is supplied with two centering vises of the interlocking type with adjustable jaws to give a capacity of from 2 in. to 12 in. (5 cm. to 30 cm.) in diameter.

The drive is by a direct-connected motor through a bronze driving gear. Alignment of all movable parts is maintained by adjustable taper shoes.

NOTES ON RECENT APPLIANCES

Portable Electric Spotlight Outfit

Consisting of a 50 amp.-hour storage battery and a spotlight with a focusing device, a portable electric spotlight outfit is being made by H. O. Rugh of 9 South Clinton Street, Chicago.

Paper-Insulated Metal-Covered Tubing

The International Conduit Corporation is making and the World Electrical Company, 18 Broadway, New York City, is distributing "Inco" paper-insulated and metal-covered tubing and fittings for use with it.

Safety Wringer-Guard for Electric Washers

To eliminate accidents such as the fingers being caught in the rolls, a wringer guard for electric washing machines has been placed on the market by the United Sales Company of 13013 Kinsman Road, Cleveland, Ohio.

Refillable Fuse

A spring-holding effect for the fuse wire is now obtained in the improved refillable fuse described in the April 5, 1919, issue of the ELECTRICAL WORLD as manufactured by the Betts & Betts Corporation, 515 West Forty-second Street, New York.

Manufacturers' Activities

CUTLER-HAMMER HONOR ROLL.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has devoted an issue of its shop paper to its men who served in the war. The honor roll includes nearly 300 names.

GOVERNOR PRICES WITHDRAWN.—The Fisher Governor Company, Marshalltown, Iowa, announced on July 19 that, owing to changes in labor and material cost, it was necessary for it to revise its discounts and withdraw all quotations on goods of its manufacture. A new discount sheet, it was stated, will be sent on application.

SALVAGE OF BRIDGEPORT EQUIPMENT.—The Bridgeport (Conn.) district salvage board, Ordnance Department, is issuing a weekly bulletin containing a list of all government property within the Bridgeport district available for sale. This property comprises buildings, building equipment, power equipment, materials, factory supplies, tools, machinery, etc. Communications should be mailed to chairman Bridgeport District Salvage Board, 945 Main Street, Bridgeport, Conn.

C. & C. ELECTRIC SALE.—William E. Tuttle, Jr., receiver for the C. & C. Electric & Manufacturing Company, Garwood, N. J., announces that the company will be sold at auction at the office of the company on Aug. 4, in three parcels as follows: (1) Land, buildings and building equipment; (2) machinery and machine tools; (3) all patterns, drawings, jigs and dies, special attachments for the manufacture of "C. & C." products, small tools such as gages, drills, reamers, arbors and taps, and patents and good will.

ROBBINS & MYERS WINDING SCHOOL STARTED.—A schoolroom for beginners in the motor-winding department has been started by the Robbins & Myers Company, Springfield, Ohio. The practice in the past has been to have the girls instruct newcomers in the department. The removal of the instruction work from the noise and bustle of the shop is expected to make it easier for both the instructors and beginners. About twenty-five pupils are now in the school. There are four instructors.

EDISON LAMP WORKS STARTS AERIAL MAIL DELIVERY OF LAMPS.—On June 8 the Edison Lamp Works of the General Electric Company delivered to the Republic Electric Company, Cleveland, Ohio, one of the new Mazda C-4 tipless lamps, via aerial mail service. The regular mail plane left Belmont Park, New York, at 5 a. m., arriving in Cleveland about noon, and the lamp was delivered to Louis Griesser, president of the Republic Electric Company, in good condition, through the regular post office channels. The transportation department of the Edison Lamp Works announces that it is now ready, in cases of emergency, to make delivery of lamps by aeroplane in all sections of the country covered by government aerial mail. It is expected that Heller Field, at Newark, the largest government landing field for aerial mail service in the East, will be ready for use shortly, and this will make for even quicker service. Packages shipped by aerial mail are limited to 30 inches in length and girth.

GEORGE H. WAHN COMPANY HOLDS OUTING.—The "Wahnco" Outing Association, composed of members of the organization of the George H. Wahn Company, electrical supply jobbers, Boston, held a field day at Canobie Lake, N. H., July 5 and 6. The party assembled at the company headquarters in Boston on the morning of July 5 for a two hours' sales conference, at which optimistic reports of conditions in the New England electrical territory were presented. At 10 o'clock about thirty left in automobiles for New Hampshire, arriving about noon at Canobie Lake Hotel, where luncheon was served. After luncheon the party repaired to the baseball park, where a lively game was enjoyed between the inside men and the traveling men, the result being a score of 7 to 3 in favor of the insiders. Athletic contests and sight-seeing trips occupied the remainder of the outing. W. J. Miller is president of the outing association, the following committees having various events in charge: Commissary, J. E. Miller, J. Flanagan, E. Mueller; athletics, H. E. Stockwell, C. Burland, H. Hayden; hotel, F. L. Mullock, E. B. Sawyer; entertainment, E. J. Voye, M. L. Smith; transportation, George H. Wahn, William Downey; grounds, H. Vaughan, J. Mueller. J. E. Miller is treasurer of the association.

J. RICHARD KOMMER has retired from the Federal Engineering Company, Pittsburgh, Pa., with which he had been associated for fifteen years.

THE IMPORT SALES COMPANY, manufacturer of the "Diamond" line of flashlamps, batteries, etc., has moved its Chicago office to 190 North State Street, which will be the headquarters of George D. Bernhardt and A. E. Simon, the company's Western representatives.

THE LAPP INSULATOR COMPANY, Leroy, N. Y., announces the appointment of the H. B. Squires Company, San Francisco, Los Angeles and Seattle, as its exclusive representative for the Pacific Coast States of Washington, Oregon and California and also for Nevada.

THE LAUNDRYETTE MANUFACTURING COMPANY is the new firm name taken by the makers of the "Laun-Dry-Ette" washing machine. The company was formerly known as the Home Specialty Company. A new factory has recently been built and occupied in Cleveland, Ohio.

JOHNSON & BENHAM, consulting engineers with offices at 150 Nassau Street, New York City, and Firestone Building, Kansas City, Mo., have succeeded the Benham Engineering Company of Oklahoma City, Okla. George A. Johnson, Harold C. Stevens, Arthur L. Mullergreen and Webster L. Benham are members of the firm.

A. E. KAISER has been appointed director of production for the Westinghouse Electric & Manufacturing Company. Mr. Kaiser's experience in the works extends over more than twenty-three years and includes the paint department field and armature machining, winding, assembling, general foreman's office, rate, central production and storekeeping departments. After spending three years in the latter, he was again called to the manager of works' office for one year, after which he was appointed assistant director of production in 1912.

PHILIP H. WARD, JR., formerly general manager and secretary in charge of sales and exports of the Chelten Electric Company, announces that he has severed his connection with the former company and has organized the Ward Electric Company, Philadelphia Stock Exchange Building, Philadelphia, Pa. The new corporation will manufacture for domestic and foreign distribution an extensive line of electrical supplies and specialties, including knife, push-button and surface snap switches, flush receptacles, new code and plug fuses, porcelains, ground clamps, etc.

E. H. WADDINGTON, president St. Louis Electrical Board of Trade and Western district manager of the pole and line material department, Western Electric Company, met with a serious accident recently while on a tour of inspection in the West. In the company's pole yards at Spirit Lake, Idaho, he was caught in a slide of poles and had his left leg broken below the knee. X-rays revealed the injury to be two fractures near the joint, and he will be confined to his home for several weeks. Mr. Waddington has been actively connected with the St. Louis Jovian League for a number of years and was a member of the committee that formulated the plan for its reorganization into the St. Louis Electrical Board of Trade. He has a host of friends who sympathize deeply with him in his misfortune.

THE CUTLER-HAMMER MANUFACTURING COMPANY of Milwaukee has recently opened an office in Detroit, at 905 Kresge Building, to expedite the handling of orders and to give the company's customers in and about Detroit better engineering service. The Detroit office is, in reality, a branch of the Chicago office and bears the same relation to it as the Cincinnati office. H. S. Kinsley, who is in charge at Detroit, has taken with him from the Chicago office C. W. Greenman and M. Dugliss, both of whom were recently mustered out of service. Prior to going to Chicago, several years ago, Mr. Kinsley was connected with the engineering department at the Milwaukee plant.

THE AUTOMATIC LIGHT COMPANY, Ludington, Mich., has added J. R. Brown, just released from war work, to its engineering force. The basement of the local federal building has been leased for a demonstrating room and a school for dealers and service men.

WILLIAM A. NUGENT, who served as a corporal in Company I, 21st Engineers, during the war, has returned from France to resume his duties with the Independent Pneumatic Tool Company as traveling representative. He has been reassigned to his old territory in Indiana.

AMERICAN BOSCH MAGNETO COMPANY, Springfield, Mass., earnings have been increasing steadily since January, according to a recent press statement. The rise is expressed in an advance from $6 to $15 per share. It is probable that the dividend rate of the company will be increased to 8 per cent in the near future.

HARRY G. STEELE, director, vice-president and manager and one of the founders of the Pittsburgh (Pa.) Transformer Company, has sold his interests in and resigned from that concern. For twenty years Mr. Steele has been active in the electrical manufacturing industry,

HARRY G. STEELE

and it is understood that he will continue in the electrical manufacturing business. Mr. Steele is one of the prominent young men of the industry, having entered the transformer business in 1899, at which time his company was a small manufacturer. The first ten years were years of steady progress in spite of continuous patent litigation, which resulted favorably to his interests. The last ten years were the most successful in his business from point of growth and volume of business done. During the war Mr. Steele was chairman of the war service transformer committee of the Electric Power Club, which represented the transformer manufacturers of the country in coöperating with the government on conservation, priorities and standardization.

ARTHUR B. REYNDERS, who has been director of production for the Westinghouse Electric Manufacturing Company since March, 1912, has been made works manager of the East Springfield Works. Mr. Reynders was graduated from the University of Tennessee as a civil engineer in 1895 and as an electrical engineer the following year. In June, 1899, he was first employed by the Westinghouse company as a draftsman on switchboards and switchboard apparatus. In 1902 he was made an engineer on circuit breakers, switches and relays, and two years later became acting assistant chief draftsman, and in the same year assistant chief draftsman. In February, 1906, Mr. Reynders was made general engineer on insulation work, and in November, 1909, he was appointed assistant to manager of engineering. In March, 1912, he became director of production. The East Springfield Works will manufacture small power motors, and automobile starting, lighting and ignition equipment, and Mr. Reynders is now supervising the installation of machinery.

Foreign Trade Notes

BRITISH FACTORIES TURN FROM WAR TO PEACE.—In the southern English counties munition factories are now turning out generators, motors and electrical fittings, and East Midland factories are turning out electrical apparatus.

FRENCH ELECTROCHEMICAL COMBINATION.—It has been reported that the Société d'Electro-Chimie is going to absorb the Société d'Electro-Chimie du Giffre and the Société des Carbures Métalliques, and to do so the capital of the company will be increased again from 18,000,000 francs to about 34,000,000 francs.

NEW TRADE-MARK LAW IN HONDURAS.—Information has been received that a new trade-mark law has been enacted in Honduras and will be in force from Aug. 1, 1919. Under the new law there will be a registration fee of $50 gold for each mark, but this increased fee will not apply to applications filed before Aug. 1.

BRITISH ELECTRICAL OUTPUT.—J. A. Bryce, chairman of the British Westinghouse Electric & Manufacturing Company, at the recent annual meeting stated that while it was too early to speak with confidence regarding the future, the conclusion of peace should improve conditions in many respects, notably in regard to political necessities and government restrictions, though the return to normal conditions must be slow. He thought that in that particular industry and in the company's particular case there was no cause for despondency. The demand for electrical products is likely to be very large, and an era of general reconstruction is opening up. Indication of competition from Germany, and especially from America, was dwelt upon.

JAPANESE WIRE AND CABLE COMPETITION.—As an instance of the competition being offered by Japanese cable in foreign markets comes a report in the London *Electrician* that at a recent meeting of manufacturers the government was urged to make a declaration of its economic policy with respect to unfair foreign competition. It was pointed out that the English cable makers, which employed some 33,000 people, had before the war exported products everywhere, including Japan. During the war, however, this was impossible, and as a result, it was stated, the Japanese built large factories and have been able to make considerable inroads upon the British trade in India and in the colonies and are to-day even serving the British home trade. The competition, it was held, was not fair. The labels on Japanese cables had been printed in imitation of the British CMA labels, using almost the identical words excepting with a very small "not" which might very easily have been overlooked by quick or careless buyers. It was pointed out that the British cable makers pay labor from $9 to $15 for a forty-seven-hour week and do not think it is fair to be placed in competition with Japanese cables manufactured by labor receiving a cent an hour.

TRANSFER OF GUATEMALAN ELECTRIC PLANT TO AMERICAN COMPANY.—The 2000-kw. electric lighting and power plant of Guatemala City (Empresa Electrica de Guatemala) was granted a thirty-year concession some twenty-five years ago for electric lighting and power service in the city of Guatemala. The enterprise has always been a German institution, and more than 90 per cent of the stock was held by the Deutsche Bank of Berlin. By executive decree of Oct. 16, 1918, this property was taken over by the Guatemala Alien Property Custodian and by later decree was declared forfeited to the Guatemala government and nationalized. By executive order this property has now been leased to Henry W. Catlin, 71 Broadway, New York, for the term of ten years, at a cash rental of $40,000 per annum, together with the option of extending the lease for an additional like period. The government concession under which the old company operated has been extended for the life of the contract and any prorogation. The lessee also becomes the preferred bidder in any future sale of the property. A list of prominent importers of electric materials in Guatemala City can be obtained from the Bureau of Foreign and Domestic Commerce or its district or coöperative offices by referring to file No. 120.240.

BELGIUM NEEDS TELEPHONE AND TELEGRAPH MATERIAL.—In Belgium the telephone and telegraph system is owned by the Belgian government. During the German occupation a great quantity of material and accessories was destroyed or taken away by the enemy, so there is a great need of material at the present time. American firms that wish to make offers for the sale of electrical apparatus or other material for telegraph or telephone installations might be interested to know, according to Consul Charles R. Nasmith, that bids should be submitted to the Administration des Télégraphes et des Téléphones, Hotel des Postes et des Télégraphes, Place de la Monnaie, Brussels. Each bid, according to official information just received at the consulate, should be accompanied with descriptions, photographs, etc., when it has to do with apparatus. As for the cables, specifications must be given, and whenever possible samples should be sent.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A firm in Australia (No. 29,964) wishes to get in communication with American exporters of electrical wires, cables, conduits, machinery, lamps, fittings, and glassware.

A firm in America (No. 29,934) is about to send a representative to Cuba to establish branch offices and desires to secure exclusive agencies from manufacturers of electrical supplies.

The representative of a firm in New Zealand (No. 29,826), who is in America for a short time, desires to be placed in touch with exporters of incandescent-lamp bulbs and electric motors.

A merchant from France (No. 29,931) who is in America desires to purchase from manufacturers only for Roumania electrical goods, electric railway cars and equipment for electric railways.

An electrical dealer in France (No. 29,921) desires to represent manufacturers of electrical goods in Brittany, except conduit, but particularly electric fans. Correspondence should be in French.

An electrical aerial trolley system to carry passengers between mountain tops is desired by a company in Portugal, (No. 29,966). Quotations should be given c. i. f. Portuguese port. Payment, credit in New York. Correspondence may be in English.

A company in the United States (No. 29,911), composed of Americans and native Finlanders, which is going to send representatives to Finland, desires to purchase and secure the agency for the sale of all kinds of electrical goods.

An electrical supply dealer in Switzerland (No. 29,575) wishes to be placed in touch with manufacturers of small motors for sewing machines, special electrical material for electrical railways, electric heating and cooking apparatus, and porcelain fittings and insulators for high and low tension.

H. F. Adams has resigned as the manager of the Haarlem (Holland) Electric Railway, and is now in this country, where he expects to purchase some apparatus, particularly motors and converters, for his property. He believes that with the signing of peace there will be a revival of Dutch electrical enterprises, and possibly extension of the existing trunk line electrification.

A firm in Brazil (No. 29,682) desires to purchase electrical materials of all kinds, such as wire cables, insulators, sockets, globes, plugs, fuses, switches and interrupters. A list and description of the supplies required was forwarded and may be examined at the Bureau of Foreign and Domestic Commerce, or its district offices. (Refer to file No. 117,955.) Correspondence should be in Portuguese.

A South African electrical power company (No. 29,899) wishes to purchase best anthracite coal, lubricating oil, every kind of article necessary for an electric, gas and power plant of 300 kw., as wires, fuses, lamps, motors, testing apparatus and instruments; articles necessary for house installations; articles necessary for a high-tension line of 30,000 volts; transformer stations, and machinery and tools for workshop. Quotations should be given f.o.b. American port or c. i. f. South African port.

Trade Publications

HAND SEARCHLIGHT.—A leaflet put up by the Grether Fire Equipment Company, Dayton, Ohio, describes the Grether hand electric searchlight, mine safety type.

UTILITY MOTOR.—A folder put out by the Dyneto Electric Corporation, Syracuse, N. Y., describes the features of the type U. M.—D utility motor for use on 32-volt circuits.

BOILERS.—A tube-scraping device for boilers is described in Bulletin S-1, issued by the Combustion Engineering Corporation, New York City. It is illustrated to show construction and use.

SWITCH.—The C.-H. "Seventy-Fifty" switch is described and illustrated in four "Dealer Helps" which have been prepared by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis.

TRANSFORMER.—The Packard Electric Company, Warren, Ohio, has issued bulletin No. 201 on the Packard power transformer. Complete information and data as to the use of the transformer are given.

INDUSTRIAL TRACTORS.—The various uses to which small electric tractors may be put are described in a booklet entitled "The Trackless Train" published by the Mercury Manufacturing Company, 4118 South Halsted Street, Chicago.

STORAGE BATTERIES.—The "Ironclad Exide" battery is the subject of a new publication issued by the Electric Storage Battery Company, Allegheny Avenue and Nineteenth Street, Philadelphia. It describes the use of the battery on industrial trucks and mine locomotives, setting forth fifteen points in its favor.

New Incorporations

THE ROCKFORD (TEX.) ELECTRIC COMPANY has been incorporated with a capital stock of $85,000 by Charles G. Johnson, D. R. Scrivner and Ed. Peets.

THE SALAMONIA (IND.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $10,000 by Peter Berger, H. E. Bartling and Peter B. Kelly.

THE PEOPLE'S LIGHT & POWER COMPANY of East Liberty, Ohio, has been incorporated with a capital stock of $20,000 by L. E. Traul, J. E. Dunaway, O. L. Sleniser, E. H. Harding and D. M. Sharp.

THE GENERAL FUEL-SAVING CORPORATION of Rochester, N. Y., has been incorporated with a capital stock of $225,000 by E. J. Shea and V. D. Ludington of Holley, N. Y. The company proposes to manufacture fuel-saving devices.

THE ELECTROLYTE STORAGE BATTERY COMPANY of Philadelphia, Pa., has been incorporated by F. R. Hansel, Land Title Building, Philadelphia, Pa., and E. M. MacFarland. The company is capitalized at $200,000 and proposes to manufacture storage batteries, etc.

THE OTTER CREEK POWER CORPORATION of Glenfield, N. Y., has been incorporated by H. S. Lewis, H. D. and G. L. Cornwall, Beaver Falls, N. Y. The company is capitalized at $35,000 and proposes to construct and operate an electric light and power plant in Glenfield.

THE CHARLESTON (W. VA.) LIGHT & HEAT COMPANY has been incorporated with a capital stock of $50,000 to construct and operate an electric power plant in Charleston. The incorporators are: A. Howard Ritter, W. H. Comfort and C. S. Newhall, all of Philadelphia, Pa.

THE AMERICAN FARM EQUIPMENT COMPANY of Williamsport, Pa., has been incorporated by Samuel J. MacMullen, William J. Housel and Charles A. Blair. The company is capitalized at $100,000 and proposes to manufacture gas engines, electric lighting plants, radiators, etc.

THE MANIFOLD LIGHT & POWER COMPANY of Winnipeg, Man., Can., has been incorporated by William Shaw, Shirley O. P. Gemmill, Harold St. C. Scarth and others. The company is capitalized at $100,000 and proposes to construct and operate electric light, heat and power plants.

New England States

PORTLAND, ME.—Bids, it is reported, are being asked by the American Can Company, 120 Broadway, New York, N. Y., for the erection of a plant in Portland, to cost, including equipment, about $300,000.

BRATTLEBORO, VT.—The capital stock of the Twin State Gas & Electric Company has been increased from $5,000,000 to $6,000,000. Samuel Insull of Chicago, Ill., is president of the company.

MEDFORD, MASS. — The American Radio & Research Corporation, Tufts College, Medford, is planning to erect a factory to cost about $250,000. A. D. Wright, 40 State Street, Medford, is architect.

NEW HAVEN, CONN.—Excavations are being made for the proposed new power house, 48 ft. by 48 ft., for the Yale Tire & Rubber Company, to be erected on Dixie Avenue, Highwood. Shiner & Appel are architects.

NEW HAVEN, CONN.—Work has been started by the Hygienic Ice Company, State Street, on the construction of its proposed new boiler and engine plant. The building will be about 74 ft. by 95 ft., and will cost about $10,000.

WAREHOUSE POINT, CONN.—Plans are being prepared for extensions to the Hartford County Home at Warehouse Point, including a new school, hospital, heating plant and dormitory, to cost about $200,000. M. J. Unkelbach, 162 Main Street, New Britain, is architect.

Middle Atlantic States

BINGHAMTON, N. Y.—The construction of a municipal electric light and power plant, to be located on Conklin Avenue, is under consideration by the Board of Contract and Supply. Frederick Smith is secretary.

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until July 29 next for new boiler, stokers, etc., for the new central heating and lighting plant at the Central Islip State Hospital, Central Islip. L. F. Pilcher, Capitol, Albany, is state architect.

GLENFIELD, N. Y.—The Otter Creek Power Corporation, recently incorporated, is contemplating the construction of a power plant to supply electricity for lamps and motors in Glenfield. S. S. Lewis and G. L. Cornwall of Beaver Falls are interested in the company.

NEW YORK, N. Y.—Plans have been filed by the Manhattan Railway Company, 165 Broadway, for extensions to its machine and repair shop at Lexington Avenue and Ninety-eighth Street, to cost about $50,000.

NEW YORK, N. Y.—Contract has been awarded by the Wappler Electric Company, 173 East Eighty-seventh Street, for the erection of a new manufacturing plant on Harris Avenue, near Queensboro Bridge, Long Island City, to the Turner Construction Company, 244 Madison Avenue. The Wappler company manufactures batteries and other electrical equipment.

OSSINING, N. Y.—The contract for electrical work in connection with the proposed additions and improvements at the Sing Sing Prison has been awarded to the Van Wagoner Linn Construction Company, 143 East Twenty-seventh Street, New York City, at $16,365.

CALIFON, N. J.—The Public Service Utility Commission has approved the application of the Califon Light & Power Company for permission to issue $10,000 in capital stock, the proceeds to be used for the extension of its transmission and distribution system from Long Valley to the south and throughout Califon. The commission has also given its approval of a contract between the Califon company and the Hackettstown (N. J.) Electric Light Company, whereby the latter will supply energy to the Califon company for a period of ten years.

HACKENSACK, N. J.—Bids will be received by the Hackensack Improvement Commission at the Municipal Building, Hackensack, until Aug. 18 for construction and equipment of disposal works, including flotation basins, power house, power transmission lines, air lines, force mains, ejectors, ejector stations, pipe, concrete and other sewers, consisting of 101,450 linear feet, together with manholes, catch basins, etc. Plans and specifications may be obtained at the office of Lemuel Lozier, engineer of the commission, Bank Building, Main and Mercer Streets, Hackensack.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

LITTLE SILVER, N. J.—Arrangements are being made by the War Department for the purchase of the property now known as Camp Alfred Vail at Little Silver. The site will be used for research and experimental works for radio apparatus.

MADISON, N. J.—The Board of Public Utility Commissioners has ordered the borough officials to make improvements to the municipal electric light plant and system.

BLAIRSVILLE, PA.—Plans are being prepared by F. McC. Crooks, architect, 530 Fourth Avenue, Pittsburgh, for hospital and group institutional buildings, near Blairsville. The cost is estimated at about $2,000,000.

ERIE, PA.—Bids will be received by the board of school directors of Erie, Pa., until Aug. 18 for construction of the new East High School building, including general work, heating, plumbing, electric work, clocks, bells, telephones and vacuum cleaning system. Plans and specifications may be obtained from R. S. Scobell, business manager, board of directors, upon deposit of $50. William B. Ittner of St. Louis, Mo., is architect.

PHILADELPHIA, PA.—Plans have been filed by the Niles-Bement-Pond Company, Twenty-first and Callowhill Streets, for the erection of a power house, 44 ft. by 60 ft., at Swanson and McKean Streets, to cost about $10,000. The company will also build a pumping plant.

WILMINGTON, DEL.—Plans are under consideration by the King Street Improvement Association for the installation of new electric lamp standards on King Street.

BALTIMORE, MD. — The Board of Awards has rejected the bid received June 11 for furnishing and installing one 25-kw. and one 15-kw. turbo-generator set and switchboard at the Mount Royal pumping station. W. E. Lee, City Hall, is water engineer.

CLEAR SPRING, MD.—A company is being organized by local business men to construct and operate an electric distributing system in this section. Negotiations are now under way with the Hagerstown & Frederick Railway Company to furnish energy from its power plant at Dam No. 5 on the Potomac River. A substation will be erected in Clear Spring.

PERRY PORT, MD.—A company has been formed by a number of business men of Cecil County to take over the power plant at Perry Point used last year by the Atlas Powder Company. The new company, it is said, will establish an ice factory and a steam laundry as well as supply electricity in Perryville, Port Deposit, Havre de Grace and other nearby towns. Commander Cole, commanding officer at Point Perry reservation, it is reported, will head the company. C. A. McCarthy of the Fred T. Ley Company, C. C. Cole, Edwin S. Dorcus and others are interested in the project.

INSTITUTE, W. VA.—Plans are being prepared for the construction of a power plant at the State Institution at Institute. Further information may be obtained from the State Board of Control, Charleston.

SISTERSVILLE, W. VA.—The Sistersville & New Martinsville Traction Company, recently incorporated to take over the Union Traction Company, is contemplating an extension of the railway to Clarington or Moundsville. Plans are also under consideration for improvements to Paden Park, a pleasure resort.

North Central States

MUSKEGON, MICH.—The Continental Motors Corporation is contemplating an addition to its present plant and the erection of a new power plant, to cost $1,000,000.

CINCINNATI, OHIO.—Bids will be received at the office of the clerk of Board of Education of Cincinnati, Denton Building, Seventh and Eighth Streets, until July 28, for furnishing material and installation of electric fixtures in the new East Side High School.

CINCINNATI, OHIO.—The City Council has adopted an ordinance authorizing a bond issue of $22,000 to repair the City Hall and to make the necessary changes in the wiring system to permit the lighting of the building by the Union Gas & Electric Company. Petitions have been filed with the City Council asking extensions to the oramental lighting system on Race Street from Twelfth Street to McMicken Avenue and on Colerain Avenue from Central Avenue to Millcreek Bridge.

CLEVELAND, OHIO.—Contract has been awarded by the Drew Electric & Manufacturing Company of Indianapolis, Ind., for the construction of its proposed plant to be erected at Collamer Avenue and the Nickel Plate Railroad, East Cleveland, to the Austin Company of Cleveland, to cost about $50,000. The company manufactures overhead fixtures for electric trolley wire.

LEBANON, OHIO.—Bonds to the amount of $120,000 have been voted for the construction of a new municipal electric light plant.

LOUISVILLE, KY.—The Southern Baptist Theological Seminary, 729 South Fifth Street, has acquired a site on Brownsboro Road, near Reservoir Park, on which it plans to erect a seminary, to include lecture hall, president's office, chapel, library, administration building, two dormitories, commons, power house, etc.

EAST ST. LOUIS, ILL.—The East St. Louis & Suburban Railway Company is considering plans for the extension of its line to Scott Field, Ill. It is proposed to extend the O'Fallon division.

BLACK RIVER FALLS, WIS.—Plans have been prepared by Mead & Seastone, architects, for a municipal electric light plant, to cost about $25,000.

FOND DU LAC, WIS.—Extensions are contemplated to the plant of the Northern Casket Company, to cost about $100,000, and will include a three-story factory addition, 100 ft. by 200 ft., a new power plant and boiler house, 80 ft. by 80 ft., with concrete stack, and garage and machine shop, 40 ft. by 80 ft. William Mauthe is president and general manager.

JANESVILLE, WIS.—Preparations are being made by the Samson Tractor Company, a subsidiary of the General Motors Corporation, for the erection of a third unit to its plant, consisting of a foundry, 300 ft. by 500 ft. A steam driven power plant, it is understood, will be built later. Frank D. Chase, Inc., of Chicago, Ill. is consulting engineer.

MILWAUKEE, WIS.—Cahill & Douglas, 128 Grand Avenue, consulting engineers, have been engaged by the Briggs & Stratton Company, 1047 Louis Avenue, to design and equip a steam-driven electric generating plant. Bids, it is understood, will soon be asked by the engineers for generators, switchboards, engines, etc., for the proposed plant.

NEENAH, WIS.—The City Council has decided to enter into a new contract with the Wisconsin Traction, Light, Heat & Power Company of Appleton for street lighting. Under the terms of the new contract a larger number of lamps will be installed in the business district and less powerful lamps in the outlying sections.

OSHKOSH, WIS.—Contract has been awarded by the Oshkosh Trunk Company for extensions to its works, including addition to power plant, 37 ft. by 87 ft. The cost of the entire work is estimated at $100,000.

BLOOMFIELD, IOWA.—The citizens have voted to rebuild and improve the municipal electric light and power plant.

BURLINGTON, IOWA.—A special election will be held to vote on the proposal to issue $30,000 in bonds for the installation of a municipal electric distributing system.

CLINTON, IOWA.—The construction of a new power plant in connection with its new passenger station in Clinton is under consideration by the Chicago & Northwestern Railroad Company of Chicago, Ill.

KANSAS CITY, MO.—Plans have been completed by the Black Steel & Wire Company for the erection of a new steel plant at its wire-rope mill. The proposed plant will consist of two furnaces for making steel ingots, together with electrically driven rolling mills, etc. W. E. Moore & Company are engineers.

ST. LOUIS, MO.—The Kellerman Construction Company has been awarded the contract for the construction of a boiler house and service station, to cost about $60,000, at the Christian Brothers' College at Hi-Point.

SIKESTON, MO.—At an election held recently the proposal to issue $90,000 in bonds to establish a municipal electric light plant was defeated.

WOODWORTH, N. D.—Bids will be received by the city of Woodworth until July 28 for the installation of a lighting system. N. Nelson is city clerk.

BROOKINGS, S. D.—Bids will be received by P. J. Erie, clerk of the Independent School District of the city of Brookings, until August 12 for construction of high school building, separate bids to be submitted as follows: (a) general work; (b) plumbing; (c) electrical work; (d) heating system; (e) ventilation system; (f) temperature and damper control systems; (g) fan equipment; (h) air washers and humidity control equipment; (i) vacuum return trap and pumping equipment. Plans and specifications may be obtained at the office of Tyrie & Chapman, architects, Auditorium Building, Minneapolis, Minn.

REDFIELD, S. D.—Bids will be received by the State Board of Charities and Corrections of South Dakota at the School and Home for Feeble-minded, Redfield S. D., until Aug. 4 for construction of a service building including general contract work, heating and ventilating, plumbing and electrical work and refrigerating system. Plans and specifications may be obtained at the office of C. H. Johnson, architect, Capital Bank Building, St. Paul, Minn.

SISSETON, S. D.—Bids will be received by the Sisseton Independent School District until July 29 for heating, plumbing and electrical work, including electrical time program clock and fire-alarm system. Plans may be obtained on application to Frank R. McKenna, clerk, Sisseton, or Foss & Foss, St. Cloud, Minn.

OSHKOSH, NEB.—Bonds to the amount of $9,750 have been voted for the installation of an electric lighting system.

LIBERAL, KAN.—The Council has authorized the installation of an ornamental lighting system covering a distance of about three-quarters of a mile.

KANSAS CITY, KAN.—The City Commissioners have awarded the contract for electric generators for the municipal electric light plant to the Westinghouse Electric & Manufacturing Company of Pittsburgh. The cost is estimated at about $232,000. Contracts for other machinery, boilers, line material, etc., have also been awarded. L. H. Chapman is water and light commissioner.

OSAWATOMIE, KAN.—Bids will be received by J. W. Allard, city clerk, Osawatomie, until July 28 for furnishing material and installing a special street-lighting system to consist of 102 metal lamp standards, steel-topped and lead-covered cable, street-lighting switchboard panel, pole-line hardware, No. 8 triple-braid waterproof wire, etc. Plans and specifications may be secured at office of the city clerk or at the office of Black & Veatch, Interstate Building, Kansas City, Mo.

PARTRIDGE, KAN.—At an election to be held Aug. 1 the proposal to issue $20,000 in bonds for the installation of an electric lighting system in Partridge and to erect a transmission line to Hutchinson to secure electricity to operate the proposed plant will be submitted to the voters.

SPRING HILL, KAN.—The electric generating station of the municipal electric light plant has been closed down, and electricity to operate the local system will be secured from Olathe, 10 miles distant.

WOODSTON, KAN.—Bonds to the amount of $13,000 have been voted for improvements to the electric light and power plant.

Southern States

HAYESVILLE, N. C.—The Public Service Company, recently incorporated with a capital stock of $125,000, is planning to supply electricity in Hayesville. The company is reported to have purchased a hydroelectric plant which it will enlarge; it also proposes to develop a water power on Shooting Creek and other streams. A transmission line, six miles long, will be erected to furnish electrical service here. The proposed project includes drilling a well for water supply, erection of a flour mill, ice and cold-storage plant. G. H. Haigler, cashier of Clay County Bank, W. J. Winchester and others are interested in the company.

JOHNSTON, N. C.—F. M. Boyd, owner of the Boyd utilities plant, is contemplating the installation of a 75-kva., 2300-volt alternator, driven by an internal-combustion engine.

WALNUT COVE, N. C.—The Piedmont Power Company, recently organized, is contemplating the erection of an electric transmission line to Winston-Salem to furnish electricity for lamps and motors in Walnut Cove and Walkertown.

FLORENCE, S. C.—Bids will be received by the Mayor and City Council, City Hall, Florence, until July 29 for waterworks improvements, including furnishing and installing motor-driven air compressors, motor-driven centrifugal pumps, air-lift deep-well apparatus and steel storage reservoir, etc. Gilbert C. White of Durham, N. C., is engineer.

MIAMI, FLA.—The Miami Beach Electric Company has been granted a franchise to construct and operate an electric light and power plant and electric railway system at Miami Beach. Carl G. Fisher and others are interested in the company.

PETERSBURG, TENN.—Bonds to the amount of $15,000 have been voted for the installation of an electric lighting system.

GUNTERSVILLE, ALA.—Surveys are being made by the Alabama Power Company for the erection of two transmission lines, one to extend from Guntersville toward Gadsden and the other toward Decatur. The proposed lines will supply energy in Albertville, Boaz, Guntersville, Huntsville, Decatur and other smaller towns. The cost is estimated at about $1,000,000. G. S. McInnish of Huntsville is chief engineer.

LAMAR, ARK.—The City Council has granted the Commonwealth Public Service Company of Fort Smith a franchise to supply electricity for lamps and motors in Lamar. The company will extend its transmission line from Jamestown to Lamar.

HOBART, OKLA.—Work, it is reported, will begin at once on the installation of the new electric lighting system, for which bonds have been sold.

TULSA, OKLA.—The Oklahoma Iron Works are contemplating the construction of a plant to cost about $500,000, including an electric power plant to cost about $180,000.

BERTRAM, TEX.—Darter & Hereford, it is reported, will rebuild their electric light plant and grist mill, recently destroyed by fire. The loss is estimated at $6,000 to $8,000.

HOUSTON, TEX.—The Houston Lighting & Power Company is contemplating extensions to its system, including the installation of additional generators and other equipment at its local power house and the erection of additional transmission lines. The cost of the proposed improvements is estimated at about $500,000. S. R. Bertron, Jr., is general manager.

SAN ANTONIO, TEX.—Plans have been prepared by the San Antonio Public Service Company for the installation of a new turbine at its power house on Conception Avenue. The cost is estimated at about $275,000.

WACO, TEX.—The Miller Cotton Mills is considering the construction of a new factory building, to be equipped with 7500 spindles and 200 looms, at a cost of about $200,000. The plans also include an electric power plant to develop about 150 hp., to cost about $20,000. Lockwood, Green & Company of Boston, Mass., are engineers. Byron Miller is president of the company.

Pacific and Mountain States

KELSO, WASH. — The North Coast Power Company has awarded contract for the erection of a substation to house three 250-kva. transformers, which will be removed from Winlock. The transformers now in use here will be removed to the Kalama River plant. The company is also rebuilding its transmission line from Kelso to Kalama. The total cost of the work is estimated at $40,000.

SEATTLE WASH.—A large quantity of electrical equipment will be required in connection with the construction of the proposed 18,000,000-ton dry dock at the plant of the Ames Shipbuilding & Drydock Company, including complete electrically operated pumping apparatus, motors, etc.

SEATTLE, WASH.—The City Council has passed a bill appropriating $1,250,000 for the construction of a new unit at the Lake Union steam power plant, work to begin at once. The appropriation provides for the construction of an additional building, two new boilers and the purchase of additional ground as a site. This improvement will increase the output of the plant by 12,500 kw.

MARSHFIELD, ORE.—The cost of the proposed improvements to the power plant at the C. A. Smith Lumber & Manufacturing Company is estimated at about $60,000.

PORTLAND, ORE.—The Northwestern Electric Company contemplates improvements to its electric and steam systems, involving an expenditure of more than $100,000. New underground electric mains are to be completed from Second and Yamhill Streets east to First Street and south to Jefferson Street, at a cost of about $22,000. A number of overhead extensions of electric lines will be made. The new steam mains will cost about $53,000.

LOS ANGELES, CAL.—The Board of Public Service has rejected all bids submitted June 27 on machinery and equipment for power plant No. 2 in San Francisquito Canyon. New bids, it is understood, will be received until Aug. 18 on various portions of material needed.

SACRAMENTO, CAL.—Bonds to the amount of $1,800,000 have been voted for the construction of filtration plant, pumping plant and caisson in Sacramento River. F. C. Miller, City Hall, is engineer.

SAN FRANCISCO, CAL.—Bids will be received by the Board of Supervisors of the city and county of San Francisco until Aug. 4 for furnishing underground cable for fire-alarm system required by the Department of Electricity. J. S. Dunnigan, City Hall, is clerk.

MACKAY, IDAHO.—The Mackay Light & Power Company has been granted permission to extend its electric transmission lines down the Lost River Valley to Arco. As a result, it is not probable that the town of Arco will carry out its plans for the erection of a municipally owned transmission line to Mud Lake, 45 miles distant, for which $60,000 in bonds were to be voted.

MANTI, UTAH.—At an election to be held soon the proposal to issue $25,000 in bonds for improvements to the municipal electric light plant will be submitted to the voters.

LIBBY, MONT. — The Tukens-Hazel Mining Company of Libby is considering the construction of a power plant and a 200-ton concentrator at its property, 9 miles from here. The cost of the power plant is estimated at about $200,000 and that of the concentrator at $240,000. The plans include a pipe line 2 miles long, giving a head of 300 ft. and developing 600 hp. C. E. Lukins is president.

Canada

CALGARY, ALTA.—The Calgary Power Company is reported to be considering an additional waterpower development.

CRESTON, B. C.—The East Kootenay Light & Power Company, it is reported, is contemplating extending its service to Creston, B. C.

KAMLOOPS, B. C.—A hydro-electric power development at Shuswap Falls on the Adams River is reported to be under consideration.

STEWART, B. C.—E. R. Workman of Stewart, B. C., is contemplating utilizing 5 cu.ft. per second of water of a stream draining into the Portland Canal, to be diverted at a point about 700 ft. from the canal and to be used for power purpose.

TORONTO, ONT.—Plans are being prepared by R. C. Harris, city engineer, for new pumping plant of 60,000,000 gal. daily capacity, filtration plant, new mains and intake at Victoria Park. The cost is estimated at about $2,000,000.

ST. RAPHAEL, QUE.—Preparations are being made by the St. Raphael Hydraulic Power Company for a water-power development. The company is asking prices on steel and frame pipes of 5.9-in. to a length of about 8000 ft. C. Camille Lessard, 1 Jacques Cartier Avenue, Quebec, is engineer.

SASKATOON, SASK.—Bids will be received by the city of Saskatoon until Sept. 23 for a new 4500-kw. turbo-generator set as follows: (1) One stem turbine, one alternating-current generator, switchgear equipment; (2) one surface condenser and condenser auxiliaries. C. J. Yorath is city commissioner. For details see Searchlight section.

Miscellaneous

PETERSBURG, ALASKA.—Steps have been taken by local citizens to organize a company to construct a hydroelectric power plant on Five Mile Creek to supply electricity in Petersburg. The City Council will coöperate with the company in construction of the project and will eventually take over the plant. The cost of the first unit is estimated at $40,000. H. P. Crowther of Juneau has charge of the engineering work.

(Issued July 1, 1919)

1,308,579. DIVER'S LANTERN; William T. Coulson, Anerley, London, Eng. App. filed Jan. 23, 1918.

1,308,589. MOTOR-CONTROL SYSTEM; George W. Huey, Wilkinsburg, Pa. App. filed Dec. 31, 1913. For automatically controlling the operation of induction motors.

1,308,590. ELECTRICAL INDICATOR AND LIKE APPARATUS; James G. Hooper and Frederick R. Hobley, Van, near Llanidloes, Wales. App. filed June 5, 1918.

1,308,607. PANELBOARD CONSTRUCTION; Edwin A. Olley, Syracuse, N. Y. App. filed Aug. 2, 1915. Width of the board is reduced to a minimum.

1,308,619. ELECTRICALLY OPERATED BRAKE MECHANISM; Charles W. Brewster, New York, N. Y. App. filed Nov. 25, 1916.

1,308,624. ELECTRIC ARC FURNACE; Henry Coates, Watford, Eng. App. filed Nov. 27, 1918. Controls a second switch closed electromagnetically onto its contacts in each of two positions.

1,308,656. EXCESS-DEMAND METER; Alfred W. Burke, Wynnewood, Pa. App. filed Dec. 16, 1918. Recording wattmeters.

1,308,655. ELECTRICAL HEATING DEVICE FOR WATCHMAKERS' USE; Bertrand E. Brown, New Haven, Conn. App. filed April 26, 1919.

1,308,664. RELAY-SELECTING CIRCUIT FOR ARTIFICIAL LINES; Charles S. Demarest, Flatbush, N. Y. App. filed June 15, 1917.

1,308,704. ELECTROLYTIC CELL FOR PRODUCTION OF OXYGEN AND HYDROGEN; Evariste Geeraerd, Prestwich, Eng. App. filed May 17, 1917.

1,308,711. CIRCUIT CLOSER; Clarence B. Harlow, Chicago, Ill. App. filed March 3, 1915.

1,308,725. SELECTING CIRCUIT FOR ARTIFICIAL LINES; John F. Toomey, New York, N. Y. App. filed June 15, 1917.

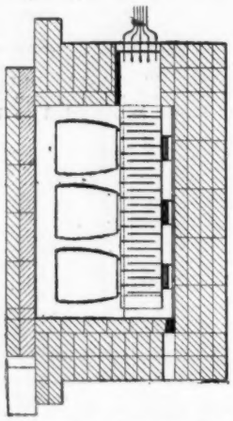
1,308,726. MEANS FOR CONTROLLING ARTIFICIAL LINES; John F. Toomey, New York, N. Y. App. filed June 15, 1917.

1,308,740. AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill.

1,308,749. AUTOMATIC TELEPHONE SYSTEM; Arthur B. Smith, Evanston, Ill. App. filed May 10, 1916.

(Issued July 8, 1919)

14,682 (reissue). ILLUMINATED SIGN OR ELECTROGRAPH; Elmer J. Kingsbury, Chicago, Ill. App. filed July 4, 1918.



1,308,880—Electric Furnace for Fusing Metals Contained in Crucibles

1,308,772. RECORDING SYSTEM AND APPARATUS; Richard M. Hopkins, New York, N. Y. App. filed Jan. 27, 1917.

1,308,778. ELECTRIC WELDING APPARATUS; James H. Gravell, Brooklyn, N. Y. App. filed Nov. 23, 1918. Strip of conductor as work-engaging surface.

1,308,781. METHOD OF WELDING THIN PLATES; James H. Gravell, Brooklyn, N. Y. App. filed Nov. 23, 1918. Uniform distribution of current.

1,308,782. TRANSFORMER SECONDARY; James H. Gravell, Brooklyn, N. Y. App. filed Nov. 23, 1918. High power factor, low temperature.

1,308,797. PROCESS OF OXIDIZING HYDROCARBONS; Karl P. McElroy, Washington, D. C. App. filed June 26, 1917. Direct limited oxidation under controlled conditions.

Record of Electrical Patents

Notes on United States Patents

1,308,805. MASSAGE APPARATUS; Charles Nehrke, Brooklyn, N. Y. App. filed Nov. 3, 1916.

1,308,830. JUNCTION BOX; Alfred A. Ziegler, Boston, Mass. App. filed Nov. 6, 1915. Panelboards and cable housing removably secured to bottom plate.

1,308,836. HEATER; Pierre J. H. Bernard, Montreal, Que., Can. App. filed Oct. 22, 1918. Renewable parts.

1,308,841. AUTOMATIC TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed May 24, 1918.

1,308,860. HEATING APPLIANCE FOR CARBURETORS; Edmund H. O'Brien, Kansas City, Mo. App. filed Jan. 4, 1919.

1,308,867. TELEPHONE-EXCHANGE SYSTEM; John N. Reynolds, Greenwich, Conn. App. filed Nov. 2, 1917.

1,308,877. ELECTRIC FURNACE FOR FUSING METALS; John Thomson, New York, N. Y. App. filed Oct. 7, 1918. Has rolling motion about a vertically extending axis.

1,308,878. METHOD FOR PREVENTING ELECTRIC CARBON RESISTORS FROM OXIDIZING; John Thomson, New York, N. Y. App. filed Oct. 7, 1918. Avoids disintegration of carbon resistors.

1,308,879. METHOD OF ELIMINATING CARBON DIOXIDE AND OXYGEN IN ELECTRIC SMELTING FURNACES; John Thomson, New York, N. Y. App. filed Oct. 24, 1918. Granular carbon eliminates carbon dioxide.

1,308,880. ELECTRIC FURNACE FOR FUSING METALS CONTAINED IN CRUCIBLES; John Thomson, New York, N. Y. App. filed Nov. 30, 1918. Resistor of carbon type.

1,308,910. TRAIN-TELEPHONE SYSTEM; John M. McIlhany and Ernest K. Kitts, Bluefield, W. Va. App. filed Jan. 30, 1918.

1,308,925. WIRELESS AND AUTOMATIC RAILWAY SAFETY SYSTEM; Harry D. Betz, Kansas City, Mo. App. filed March 1, 1915.

1,308,927. MOTOR-CONTROL SYSTEM; Harry R. Canfield, Cleveland, Ohio. App. filed April 6, 1916. Automatic.

1,308,946. HOLDER FOR RESISTANCE COILS; Benjamin E. Grisham, Memphis, Tenn. App. filed Oct. 14, 1916.

1,308,948. METHOD OF PRODUCING LEAD SALTS; Ralph M. Harrington, Brooklyn, N. Y. App. filed Sept. 27, 1917.

1,308,958. ELECTRIC SIGNAL-TRANSMITTING MEANS; Judson McFell, Chicago, Ill. App. filed Sept. 13, 1915.

1,308,959. PORTABLE ELECTRICAL GENERATING APPARATUS; William H. Mason, Easton, Pa. App. filed Dec. 15, 1914. Operated by fluid pressure.

1,308,977. ELECTRICAL RECEPTACLE; Reuben B. Benjamin, Chicago, Ill. App. filed April 30, 1917.

1,308,983. ELECTRIC REGULATION; John L. Creveling, New York, N. Y. App. filed April 19, 1911. Charges automatically.

1,308,994. ELECTRIC SOLDERING IRON; Even J. Rohne, Minneapolis, Minn. App. filed April 29, 1916.

1,309,001. ROTARY CONVERTER; Carl Tretin, Berlin, Germany. App. filed June 7, 1915. Commutation zones of the two sides of each converter displaced relatively to each other.

1,309,027. FUSE CONTROL FOR MULTIPHASE CIRCUITS; Charles Gilliett, Toronto, Ont., Can. App. filed April 5, 1918. Opens circuits.

1,309,031. AERIAL CONDUCTOR FOR WIRELESS SIGNALING AND OTHER PURPOSES; John Hettinger, Streatham, London, Eng. App. filed June 4, 1917.

1,309,045. ELECTRIC FURNACE AND PROCESS OF OPERATING SAME; William E. Moore, Pittsburgh, Pa. App. filed Aug. 9, 1918. Conducting bottom.

1,309,070. MANUFACTURE OF LAMPBLACK; Thomas W. S. Hutchins, Middlewich, Eng. App. filed Oct. 16, 1918. Disk forms one of arc electrodes.

1,309,108. MOUNTING FOR CONTACT FINGERS AND METHOD OF ADJUSTING THE SAME; Clarence S. Snavely, Wilkinsburg, Pa. App. filed Dec. 15, 1916. Adjustable finger.

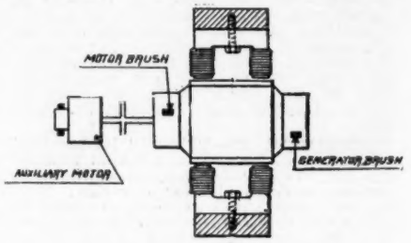
1,309,135. IGNITION AND STARTER CONTROL FOR AUTOMOBILES; Newell A. Honeywell and Charles O. McKaig, Inglewood, Cal. App. filed Feb. 13, 1918.

1,309,140. PORTABLE SEARCHLIGHT; James H. Knoblock, Elmira, N. Y. App. filed Feb. 9, 1917. Ready manipulation.

1,309,148. ELECTROLYTIC CELL; William G. Michel, Niagara Falls, N. Y. App. filed July 7, 1917.

1,309,153. ELECTRIC SWITCH; Clarence D. Platt, Bridgeport, Conn. App. filed May 18, 1918. Silent action.

1,309,158. JOINT FOR ELECTRIC CABLES; Albert E. Tanner, Stretford, Eng. App. filed May 10, 1916. Electrical stresses overcome and electrostatic pressure reduced.



1,309,001—Rotary Converter

1,309,159. ELECTRIC MOTOR; Russell E. Taylor, New York, N. Y. App. filed March 2, 1917. Avoids use of sliding contacts.

1,309,160. METHOD AND APPARATUS FOR MARKING METAL; George A. Thornton, Cleveland, Ohio. App. filed Dec. 18, 1917.

1,309,176. SELECTING SYSTEM; John H. Bell, East Orange, N. J. App. filed Aug. 29, 1917.

1,309,181. VARIABLE RESISTANCE; Theodore W. Case, Scipio, N. Y. App. filed Oct. 9, 1917. Resistance decreases inversely to intensity of light.

1,309,214. METHOD OF REMOVING CERTAIN IMPURITIES FROM ELECTROLYTIC CELLS; Hugh K. Moore, Berlin, N. H. App. filed March 25, 1919.

1,309,222. SIGNAL; Bernard L. Schwartz, Cincinnati, Ohio. App. filed Nov. 24, 1917.

1,309,231. SWITCHING APPARATUS; Edgar W. Adams, East Orange, N. J. App. filed Feb. 14, 1918. Movable contacts driven by motive means.

1,309,233. PROTECTIVE DEVICE FOR ELECTRICAL APPARATUS; Allison Akin, East Orange, N. J. App. filed Oct. 4, 1915. Thermally operable.

1,309,234. ELECTRIC WATER HEATER; Guy Arthur, Ritzville, Wash. App. filed July 6, 1918.

1,309,248. AUTOMATIC TELEPHONE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed July 28, 1917.

1,309,253. CONNECTOR; Charles W. Lowe, Jersey City, N. J. App. filed Feb. 5, 1917.

1,309,256. WINDING AND REWINDING MECHANISM; Louis E. Mackey and Frank W. Ormiston, Detroit, Mich. App. filed Aug. 5, 1918. Gear slides on motor shaft.

1,309,283. RADIO-TELEGRAPHY; Leonard F. Fuller, San Francisco, Cal. App. filed Sept. 4, 1917.

1,309,285. RECORDING SYSTEM AND APPARATUS; Richard M. Hopkins, New York, N. Y. App. filed May 31, 1917. Automatic resetting.

1,309,286. DETECTOR DEVICE; Richard M. Hopkins, New York, N. Y. App. filed Sept. 7, 1917. Single relay.

1,309,287. RECORDING SYSTEM AND APPARATUS; Richard M. Hopkins, Rutherford, N. J. App. filed Dec. 28, 1917.

1,309,304. AUTOMATIC SWITCH; John N. Reynolds, Greenwich, Conn. App. filed Jan. 8, 1918. Movable bars with plurality of sets of rigid contacts.

1,309,346. OIL-COOLED ELECTRIC APPARATUS; Albert Werner, Berlin-Friedenau, Germany. App. filed March 23, 1915. Moisture prevented from entering induction transformer.

1,309,362. AUTOMATIC ALARM VALVE; Adolph Lehmann, Hicksville, N. Y. App. filed June 29, 1917. Prevents boiler being blown down too far.